



PORTLAND HARBOR RI/FS

ROUND 2 QUALITY ASSURANCE PROJECT PLAN

ADDENDUM 11: SEDIMENT CHEMICAL MOBILITY

TESTING

DRAFT

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April 18, 2008

Prepared for
The Lower Willamette Group

Prepared by
Integral Consulting Inc.

IC08-0007

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Eric Blischke
US Environmental Protection Agency,
805 SW Broadway, Suite 500
Portland, OR 97205

From: Maja Tritt
Integral Consulting, Inc.
7900 SE 28th Street, Suite 410
Seattle, WA 98040

Date: April 18, 2008

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SECTION A: PROJECT MANAGEMENT

A1 Title and Approval Sheet

PORTLAND HARBOR RI/FS SEDIMENT CHEMICAL MOBILITY TESTING

Quality Assurance Plan Approvals

U.S. EPA Project Manager:	Chip Humphrey	_____	Date:	_____
U.S. EPA Project QA Manager:	Ginna Grepo-Grove	_____	Date:	_____
CERCLA Project Coordinator:	Gene Revelas	_____	Date:	_____
Integral Sampling and Analysis Coordinator and Field QA Manager:	Nick Varnum	_____	Date:	_____
Integral Chemistry QA Manager:	Maja Tritt	_____	Date:	_____
ARI Laboratory Project Manager:	Sue Dunnihoo	_____	Date:	_____
ARI Laboratory QA Manager:	Dave Mitchell	_____	Date:	_____
Vista Laboratory Project Manager:	Martha Maier	_____	Date:	_____
Vista Laboratory QA Manager:	Rose Harrelson	_____	Date:	_____

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A2.2 List of Acronyms

ACG	analytical concentration goal
ARI	Analytical Resources Inc.
ASTM	American Society for Testing and Materials
CDF	confined disposal facility
CVAA	cold vapor atomic absorption spectrometry
DOC	dissolved organic carbon
EPA	U.S. Environmental Protection Agency
FSP	field sampling plan
GPC	gel permeation chromatography
GC/ECD	gas chromatography/electron capture detector
GC/MS	gas chromatography/mass spectrometry
iAOPC	initial areas of potential concern
iCOC	initial contaminants of concern
HRGC/HRMS	high-resolution gas chromatography/high-resolution mass spectrometry
ICP/AES	inductively coupled plasma/atomic emission spectrometry
ICP/MS	inductively coupled plasma/mass spectrometry
LWG	Lower Willamette Group
MDL	method detection limit
MET	modified elutriate test
MRL	method reporting limit
PAH	polycyclic aromatic hydrocarbon
PARCC	precision, accuracy, representativeness, completeness, and comparability
PCB	polychlorinated biphenyl
PSEP	Puget Sound Estuary Program
QA	quality assurance
QAPP	quality assurance project plan
QC	quality control
RI/FS	remedial investigation and feasibility study
SBLT	sequential batch leachate test
SIM	selected ion monitoring
SOP	standard operating procedure
SVOC	semivolatile organic compound
TCLP	toxicity characteristic leaching procedure
TDS	total dissolved solids
TIC	tentatively identified compound

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TOC	total organic carbon
TSS	total suspended solids
USACE	U.S. Army Corps of Engineers
Vista	Vista Analytical Laboratory
VOC	volatile organic compound
ZHE	zero headspace extractor

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A3 Distribution List

U.S. EPA Remedial Project Manager:	Chip Humphrey
U.S. EPA Remedial Project Manager:	Eric Blischke
U.S. EPA QA Manager:	Ginna Grepo-Grove
Oregon Department of Environmental Quality:	Jim Anderson
NOAA:	Helen Hillman
U.S. Fish & Wildlife Service:	Ted Buerger
Columbia River Inter-Tribal Fish Commission:	Patti Howard
Yakama Nation:	Sheila Fleming
Confederated Tribes of the Warm Springs Reservation of Oregon:	Brian Cunningham
Confederated Tribes of the Umatilla Indian Reservation:	Audie Huber
Confederated Tribes of the Siletz Indians:	Tom Downey
Nez Perce Tribe:	Erin Madden
Confederated Tribes of the Grand Ronde Community of Oregon:	Jeff Baker
Port of Portland:	Jim McKenna
Port of Portland:	David Ashton
Northwest Natural:	Bob Wyatt
Anchor Environmental LLC:	Valerie Oster
CERCLA Coordinator:	Gene Revelas
Integral Sampling and Analysis Coordinator, Field QA Manager:	Nick Varnum
Integral Field Coordinator:	Joss Moore
Integral Chemistry QA Manager:	Maja Tritt
Anchor Environmental:	Carl Stivers
ARI Project Manager:	Sue Dunnihoo
ARI QA Manager:	Dave Mitchell
Vista Project Manager:	Martha Maier
Vista Laboratory QA Manager:	Rose Harrelson

A4 Introduction and Project Organization

A4.1 Introduction

This quality assurance project plan (QAPP) addendum describes procedures that will be used to conduct sediment chemical mobility tests for the remedial investigation and feasibility study (RI/FS) of the Portland Harbor Superfund Site (Site). Specifically, this information will be used in the FS portion of the project to evaluate chemical mobility under various removal and disposal scenarios.

This QAPP addendum supplements the Round 2 QAPP (Integral and Windward 2004). The Round 2 QAPP describes procedures and requirements for the generation of data of documented and acceptable quality that will be used for the RI/FS. This QAPP addendum addresses procedures that will be used for the sediment chemical mobility investigation that are not described in the Round 2 QAPP.

Study objectives, station locations, and sample collection and shipping procedures are described in the Sediment Chemical Mobility Testing Field Sampling Plan (FSP; Anchor 2008). The Sediment Chemical Mobility FSP and this QAPP addendum provide the procedures to accomplish the following types of activities and data collection (as summarized in Table A4-1):

- Perform Modified Elutriate Test (MET¹), Sequential Batch Leachate Test (SBLT) (USACE 2003), and Toxicity Characteristic Leaching Procedure (TCLP) (40 CFR §261.24) chemical mobility tests on sediments from select initial areas of potential concern (iAOPCs) with elevated concentrations of initial chemicals of concern (iCOCs)
- Complete chemical analysis of MET elutriate, SBLT leachate, and TCLP leachate
- Complete chemical analysis of bulk sediment to evaluate the quality of the sediment collected to perform MET, SBLT, and TCLP
- Complete chemical analysis of surface water used in MET.

Supplemental information to Sections A and B of the Round 2 QAPP is provided in this QAPP addendum. Special training and certification requirements are described in Section A8 of the Round 2 QAPP, and specifications for documents and records are described in Section A9 of the Round 2 QAPP; these items are not addressed further in this QAPP addendum. Supplemental information provided in Section B and referred to in the Round 2 QAPP is summarized in the introduction to Section B.

¹ This test is now called the Effluent Elutriate Test (EET) in the most recent U.S. Army Corps of Engineers (USACE) guidance on these tests (USACE 2003). However, the older term MET is used for convenience given that more people are familiar with that historical name.

Procedures for project assessment and oversight will be completed as described in Section C of the Round 2 QAPP, with the exception that laboratories will only be audited if serious problems are encountered. Analytical Resources, Inc. (ARI) was audited previously in connection with work completed for Round 1 of the Portland Harbor RI/FS. The role of Vista Analytical Laboratory (Vista; formerly known as Alta Analytical Laboratory) has been limited to analysis of polychlorinated biphenyl (PCB) congeners in sediment, and the quality of its data for Round 2 samples was very good. Anchor may audit ARI regarding their specific procedures for MET and SBLT extractions depending on lab performance.

Procedures for data validation will be completed as described in Section D of the Round 2 QAPP. No further supplemental information is required for QAPP Sections C and D.

A4.2 Project and Task Organization

The organizational structure for activities associated with the sediment chemical mobility investigation is provided in Section 3.1 of the Sediment Chemical Mobility FSP (Anchor 2008). Contact information for key project personnel for the sediment chemical mobility investigation is provided in Table A4-2 of this QAPP addendum.

Analyses for dioxins and PCB congeners for all sample types will be completed by Vista, located in El Dorado Hills, California. MET, SBLT, and TCLP and the remaining chemical analyses will be completed by ARI, located in Tukwila, Washington. The laboratory project and quality assurance (QA) managers are identified in Table A4-2. Their responsibilities are described in the Round 2 QAPP.

A5 Problem Definition and Background

The Portland Harbor RI/FS began in 2001 and has proceeded through three rounds of data collection, including physical conditions; fish, shellfish, and invertebrate tissue chemistry; surface and subsurface sediment chemistry; sediment toxicity testing; surface water chemistry; transition zone water chemistry and supporting measurements; and stormwater data among others.

The U.S. Environmental Protection Agency (EPA) has requested that sediment chemical mobility testing be conducted to support the FS by evaluating the mobility of chemicals in contaminated material that may potentially be removed from selected iAOPCs. At this stage in the RI/FS process, exact locations of potential dredge areas, dredge volumes, and the range of conditions where dredged materials may be disposed of are unknown. The MET, SBLT, and TCLP sediment mobility tests provide the most value at the FS stage of the project given that identification of dredge material and disposal options is preliminary at this time. This information will be used directly in the feasibility evaluation of capping, dredging, containment, and disposal options.

The objectives of the sediment chemical mobility sampling program are to assess the mobility of chemicals in sediments from iAOPCs where iCOC concentrations are relatively high for the Site. At the FS stage of the project, it is reasonable to assume that areas with higher chemical concentrations will likely have sediment removal as an evaluated option later in the FS. Sampling efforts will target these areas where known sediment chemical concentrations are elevated, and will focus on collecting sediments that would represent a range of chemical concentrations within each selected area. Although areas of higher concentrations are more likely to be subject to removal, disposal, and capping, these technologies will be applied to relatively wide areas and large volumes of sediments. Thus, the sampling should not focus exclusively on just the area represented by a single location of highest concentrations within each iAOPC.

The sampling effort will include collection of sediments that will be subjected to three types of elutriate or leachate production protocols: MET, SBLT, and TCLP. These tests are commonly used to understand potential environmental impacts associated with various remediation and disposal technologies for contaminated sediments (USACE 2003). They are most commonly performed in design phases of work, but can also be conducted for sediment FS reports and other preliminary evaluations.

The MET, SBLT, and TCLP test protocols are intended to provide information about leachate or elutriate production and chemical concentrations during various stages of removal and disposal. The MET protocol is intended to simulate conditions in effluent from a confined disposal facility (CDF) as it is being filled using Site sediments and surface waters. The SBLT protocol is intended to provide information on the leaching characteristics of chemicals in sediments that can be applied to several types of disposal situations and is also useful in evaluating chemical migration in *in-situ* capping scenarios. The TCLP protocol is a standard regulatory procedure for simulating leachate production in an upland landfill. Federal regulations (40 CFR §261.24) use the results of this test to determine whether a material should be classified as a hazardous waste. To support these tests, analysis of subsurface bulk sediment chemistry and surface water chemistry will also be conducted to understand the chemical levels already present in the materials used in the tests.

Elutriate and leachate data will be used in the FS to:

- Predict effluent chemical concentrations for dredged material from a confined disposal facility (MET elutriate)
- Estimate leaching of sediments in various confined disposal scenarios (SBLT leachate)
- Estimate the range of disposal facility sizes for dredged contaminated sediment such as CDFs (MET elutriate)
- Refine evaluations and costs for the use of disposal facilities (MET and SBLT)

- Refine evaluations and the effectiveness of in-situ caps at the Site (SBLT)
- Evaluate sediments for hazardous waste criteria (TCLP).

Bulk sediment data collected will allow an understanding of the relationship between bulk sediment chemical levels and leachate/elutriate chemical levels. In the case of the SBLT, the paired sediment/leachate data allows derivation of site-specific partitioning relationships. Surface water chemistry data will be used to understand whether chemicals present in MET elutriates originate from surface water rather than the sediments.

A6 Task Description

The tasks to be completed for the sediment chemical mobility investigation include the following:

- Subsurface sediment sample collection for chemical analysis and MET, SBLT, and TCLP protocols
- Surface water collection for chemical analysis and conducting the MET protocol
- Laboratory performance of MET, SBLT, and TCLP protocols
- Laboratory analysis of surface water; subsurface sediment bulk samples; and MET elutriate, SBLT leachate, and TCLP leachate samples
- Data validation and data quality evaluation
- Data management
- Report preparation.

Summaries of field and laboratory tasks and references to detailed descriptions are provided in this section. Procedures for data quality evaluation, data management, and report preparation are described in the Round 2 QAPP.

A6.1 Sample Collection and Processing

Subsurface sediment and surface water samples will be collected for the sediment chemical mobility investigation. For MET and SBLT samples, sediment from four locations will be collected and composited to create a single sample for each selected iAOPC. For TCLP samples, sediment from a single core will be homogenized for testing. Sediment core samples will be collected using a vibracorer equipped with 14-ft core tubes from the locations shown in Figures 2-1 and 2-2 of the Sediment Chemical Mobility FSP for MET/SBLT and TCLP protocols, respectively. Sediment sampling procedures are described in detail in Section 7.5.1 of the Sediment Chemical Mobility FSP. Surface water samples will be collected using a peristaltic pump as described in Section 7.5.2 of the Sediment Chemical Mobility FSP. A total of 11 sediment samples and 11 surface water samples will be collected for MET and SBLT. Eleven sediment

samples will also be collected for TCLP. Sampling procedures are summarized in Section B2 of this QAPP addendum.

A6.2 Laboratory Mobility Tests, Chemical Analyses, and Deliverables

Sediment chemical mobility tests and analyses for chemical constituents other than PCB congeners and dioxins will be completed by ARI. Vista will complete the PCB congener and dioxin analyses for all sample types. Laboratory procedures for the mobility tests are summarized in Sections 4.0 through 6.0 of the Sediment Chemical Mobility FSP. Standard operating procedures (SOPs) for the mobility tests are provided in Appendices A through C of the Sediment Chemical Mobility FSP.

Bulk sediment samples for the MET/SBLT protocols will be analyzed for inorganic and organic constituents and conventional parameters using methods summarized in Table A6-1. Surface water, MET elutriate samples, and SBLT leachate samples will be analyzed for inorganic and organic constituents and conventional parameters using methods summarized in Table A6-2. All MET elutriate and SBLT leachate samples will be analyzed for both total and dissolved inorganic and organic constituents. The MET elutriate and SBLT leachate samples will be filtered for dissolved metals using a 0.45- μ m filter. For dissolved organic constituents, the MET elutriate samples will be centrifuged, and the SBLT leachate samples will be filtered using a 1- μ m filter with a 4- μ m pre-filter.

Bulk sediment samples used for TCLP and the TCLP leachates will be analyzed for inorganic and organic constituents as shown in Tables A6-5 and A6-6, respectively. Analytical methods for TCLP bulk sediments and leachates are shown in Tables A6-1 and A6-2, respectively. The sediment and leachate samples will be analyzed for metals (including mercury), semivolatile organic compounds (SVOCs), volatile organic compounds (VOCs), organochlorine pesticides, and chlorinated herbicides. The TCLP leachate samples will be filtered using a 0.6- to 0.8- μ m glass fiber filter as specified in EPA method 1311, *Toxicity Characteristic Leaching Procedure* (EPA 2008).

Chemical mobility tests and laboratory analyses will be completed using EPA methods and other established methods as indicated in Tables A6-1 and A6-2. Laboratory data deliverables will be provided as described in Section A9.2 of the Round 2 QAPP. Complete analyte lists with method detection limits (MDLs), and method reporting limits (MRLs) are provided in Table A6-3 for MET and SBLT sediment samples; in Table A6-4 for the surface water, elutriate, and leachate samples; in Table A6-5 for TCLP sediment samples; and in Table A6-6 for TCLP leachate samples.

A6.3 Project Schedule

Actual start dates for the sediment chemical mobility sampling will be determined following EPA approval of the Sediment Chemical Mobility FSP. Other conditions that may affect the sampling schedule are weather, river flows and stages, and equipment conditions and availability. Currently, it is anticipated that the sediment chemical mobility testing field investigations will begin in the summer of 2008.

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Reporting of sediment chemical mobility sediment sampling results is discussed in Section 10.2 of the Sediment Chemical Mobility FSP.

A7 Quality Objectives and Criteria for Measurement Data

A7.1 Data Quality Objectives

Data quality objectives for the Portland Harbor RI/FS are described in Section 7 of the Work Plan (Integral et al. 2004). Analytical concentration goals (ACGs) were established during Round 1 for sediment and during Round 2 for surface water to identify analytical sensitivity levels that would be sufficient to determine ecological and human health risks for the Portland Harbor RI. Method modifications were implemented for water and sediment analyses to increase the sensitivity of various methods to meet ACGs to the extent that this was possible and practical. The project detection and reporting limits are the result of the specific laboratories and methods that were used for the RI work. These project limits are included in Tables A6-3 through A6-6.

ARI will not be able to meet the project detection limits and/or reporting limits for some cases, although the ARI limits are generally close to the project limits. In the case of elutriate water, Table A6-4 also shows that ARI's detection and/or reporting limits may be higher than potential water quality criteria that may be used as benchmarks in the FS evaluation of the dredge alternatives. However, in some cases the project limits are also above these same potential benchmarks. Consequently, it does not appear that ARI's inability to meet these limits will demonstrably limit the use of MET results in the FS evaluations. ARI is the preferred laboratory because they have greater familiarity and experience with running the MET (and SBLT). (It should be noted that MET detection and reporting limits should be compared to freshwater continuous concentration criteria, but not the human-health-consumption-based criteria, because effluent discharges do not represent a long-term impact relevant to the bioaccumulation pathway.)

A7.2 Data Quality Indicators

The overall quality objective for the sediment chemical mobility investigation is to develop and implement procedures that will ensure the collection of representative data of known and acceptable quality. The QA procedures and measurements that will be used for this project are based on EPA and Puget Sound Estuary Program (PSEP) guidance (EPA 1983, 1994, 1999, 2005, 2008; Plumb 1981; PSEP 1986, 1997a,b,c) and on established laboratory methods from other sources.

Quality control (QC) samples and procedures are specified in each method protocol that will be used for this project. Methods are summarized in Table A6-1 for bulk sediment and Table A6-2 for surface water, MET elutriate, and SBLT and TCLP leachate samples. All QC requirements will be completed by each laboratory as described in the protocols and in the Round 2 QAPP. Laboratory control limits for QC samples and procedures are provided in Tables A7-1 through A7-4. QC procedures are described in the laboratory

QA manuals (provided previously to EPA) and cited methods (Tables A6-1 and A6-2). Data validation criteria and procedures are described in Sections D1 and D2 of the Round 2 QAPP. During data validation, low matrix spike or surrogate recoveries will be reviewed for analytes with wide laboratory control limits to evaluate potential bias of the data. Data will be qualified on this basis if a bias is identified. PARCC parameters (i.e., precision, accuracy or bias, representativeness, completeness, comparability) are described in Section A7.2 of the Round 2 QAPP.

Target MRLs for this study are summarized in Tables A6-3 through A6-6. Laboratory methods are described below in Section B4. MDLs have been determined by each laboratory for each analyte, as described in Section A7-2 of the Round 2 QAPP. MDLs are provided in Tables A6-3 through A6-6.

Analyte concentrations for this investigation will be reported to the MDL, as described in Section A7-2 of the Round 2 QAPP. For high-resolution gas chromatography/high-resolution mass spectrometry (HRGC/HRMS) analyses (i.e., chlorinated dioxins/furans and PCB congeners), sample-specific detection limits will be reported as described in EPA methods 1613B and 1668A (EPA 1994, 1999).

SECTION B: DATA GENERATION AND ACQUISITION

Section B of this Round 2 QAPP addendum includes the following supplemental sections:

- B1 Sampling Process Design
- B2 Sampling Methods
- B3 Sample Handling and Custody
- B4 Field and Laboratory Methods
- B5 Quality Control.

The following information is provided in the Round 2 QAPP and is not addressed further in this QAPP addendum:

- B6 Instrument/Equipment Testing, Inspection, and Maintenance
- B7 Instrument/Equipment Calibration and Frequency
- B8 Inspection/Acceptance of Supplies and Consumables
- B9 Non-direct Measurements
- B10 Data Management.

Details regarding field documentation for sediment collection are provided in the Sediment Chemical Mobility FSP (Anchor 2008).

B1 Sampling Process Design

The sediment chemical mobility investigation sampling effort will include the following activities:

- Surface water collection using a peristaltic pump
- Subsurface sediment cores collected using a vibracore sampling device.

The complete sampling design (including station locations, types and numbers of samples that will be collected, the rationale for collection, and the analyses that will be performed), as well as detailed sample collection and handling methods, are described in the Sediment Chemical Mobility FSP.

B2 Sampling Methods

This section outlines sample collection methods, equipment, and sample requirements for surface water and sediment samples. Procedural details and SOPs for field methods are provided in the Sediment Chemical Mobility FSP. Sample containers, sample size requirements, preservation, and holding times are summarized in Table B2-1. Corrective actions are addressed in Sections B2.3 and C1 of the Round 2 QAPP.

B2.1 Sample Collection and Processing Procedures

Samples to be collected for the sediment chemical mobility investigation include 14-ft sediment cores and surface water. Sediment cores will be collected using a vibracorer. Surface water will be collected using a peristaltic pump. Field QA samples are presented in Table B2-2 and will consist of field splits. Field splits will be submitted to the laboratories as blind samples. Detailed descriptions of the sediment collection, homogenization, and characterization procedures are provided in Section 7.0 of the Sediment Chemical Mobility FSP.

B3 Sample Handling and Custody

Sample custody procedures are described in Section B3 of the Round 2 QAPP. Sample preservation and storage requirements and holding times for the sediments are provided in Table B2-1 of this QAPP addendum.

All samples will be stored in a cooler with ice on board the sampling vessel and transported to the field laboratory at the end of the day and placed in a refrigerator until shipment to the laboratories. All samples will be transferred to the analytical laboratories in coolers with ice and stored refrigerated at the laboratories (Table B2-1). Sediment remaining after MET and SBLT analysis will be archived frozen (-20°C).

B4 Analytical Methods

Laboratory methods to be used for the surface water, bulk sediment, and elutriate/leachate analyses are consistent with requirements provided in EPA methods and other widely accepted protocols (EPA 1983, 1994, 1999, 2005, 2008; Plumb 1981; PSEP 1986, 1997a,b,c). Modifications will be made to these methods, as necessary and technically feasible, to improve MRLs. Analytes and MRLs for surface water, bulk sediment, and elutriate/leachate samples are provided in Tables A6-3 through A6-6. Method modifications will not be sufficient to reduce MRLs to the level of the project reporting limits for several analytes, and project reporting limits will not be attained in these cases when the analyte is not detected.

Sediment chemical mobility testing samples will be analyzed for the constituents as shown in Table A6-3 for bulk MET/SBLT sediments; Table A6-4 for surface water, MET

elutriates, and SBLT leachates; and Tables A6-5 and A6-6 for TCLP sediments and leachates, respectively.

The laboratory methods for sample preparation and analysis are summarized in Table A6-1 for sediment samples and Table A6-2 for surface water, elutriate, and leachate samples.

Sediment samples will be analyzed as described in the Round 2 QAPP. Modifications or refinements to QAPP procedures are included below.

B4.1 Bulk Sediments – MET/SBLT

Conventional Analyses

Conventional analyses of MET/SBLT sediment samples will include total solids, grain-size distribution, total sulfides, ammonia, and total organic carbon (TOC). EPA and PSEP methods will be used as shown in Table A6-1 and described in the Round 2 QAPP.

Total solids will be determined according to PSEP (1986). These results will be used to calculate analyte concentrations on a dry-weight basis and will also be reported in the database.

For the chemical analysis of sediment samples, grain-size analysis will be completed using PSEP (1986) protocols as described in the Round 2 QAPP. This procedure includes determination of the silt and clay fractions using the pipette method. The following grain-size intervals will be reported:

Medium gravel	Fine sand	Very fine silt
Fine Gravel	Very fine sand	Clay, phi size 8-9
Very coarse sand	Coarse silt	Clay, phi size >9
Coarse sand	Medium silt	
Medium sand	Fine silt	

Total sulfide analysis will include distillation of the sulfide into a sodium hydroxide trap (PSEP 1986) and analysis by colorimetry.

Ammonia will be analyzed by EPA method 350.1. The method, originally developed for use in water samples, will be modified for sediment samples by adding an extraction with a potassium chloride solution. Colorimetry will be used to determine ammonia concentrations.

TOC will be analyzed by Plumb 1981. Samples will be pretreated with hydrochloric acid to remove inorganic carbon, dried at 70°C, and analyzed by combustion in an induction furnace.

Specific gravity will be measured on selected sediment samples in accordance with ASTM D854. The specific gravity of samples is one of the engineering properties used in the evaluation of sediment consolidation.

Metals

MET/SBLT sediment samples will be analyzed for metals as described in the Round 2 QAPP, with the following modifications. Analyses for zinc may be completed by EPA method 6010B (inductively-coupled plasma/atomic emission spectrometry [ICP/AES]) rather than EPA method 6020 (inductively-coupled plasma/mass spectrometry [ICP/MS]). Since the concentrations of these analytes are expected to be sufficiently high, they may need to be reported from the ICP/AES analysis for all samples. Zinc required multiple dilutions for analysis by ICP/MS due to matrix interferences in previously analyzed Round 2 samples (Integral 2005). For ICP/MS analyses, ARI will use EPA method 200.8 rather than EPA method 6020. Method 200.8 is very similar to EPA method 6020 and will provide data that are comparable in quality to previous data.

Organic Compounds

Phthalate and polycyclic aromatic hydrocarbon (PAH) analyses will be completed by ARI using a series of two analyses. These analyses include the following components:

1. Prescreening of the samples to determine the approximate levels of analytes and matrix interferences.
2. Analysis of phthalates by gas chromatography/mass spectrometry (GC/MS) with selected ion monitoring (SIM), if applicable, at an appropriate dilution as determined by the screening.
3. Analysis of PAHs by GC/MS –SIM after silica gel cleanup.

Sonication extraction will be used for the phthalates and PAHs. Gel permeation chromatography (GPC) cleanup will be used for phthalates and PAHs, and silica gel cleanup will additionally be used for PAH analyses if necessary. In the absence of significant matrix interference, it may be possible to complete a single analysis for PAHs and phthalates.

For pesticide analyses, an equivalent dry-weight mass of 25 g will be extracted and taken to a final volume of 5.0 mL after appropriate cleanup(s). Silica gel and sulfur cleanups will be performed. The extracts will be run against a low-level calibration curve to produce the MRLs listed in Table A6-3. The method will be modified by adding analysis of PCB interference check standards to the pesticide analysis to allow evaluation of the pesticide chromatograms for PCB interference, as requested in recent EPA Region 10 guidance for organochlorine pesticide analysis (EPA 2005). PCB interference check standards will be analyzed within 72 hours of the sample if interference is noted during the laboratory's review of the pesticide chromatograms. The PCB interference check standard will be used to determine which column to use to quantify the pesticides, in the case when PCBs only interfere on one column. The PCB interference check standards will be reviewed during validation to evaluate the laboratory's quantification of pesticide results and to qualify data when interference is present.

For PCB Aroclor analyses, an equivalent dry-weight mass of 25 g will be extracted and taken to a final volume of 1.0 mL after appropriate acid, sulfur, and silica gel cleanups. Multiple acid cleanups are not necessarily expected, but will be employed if necessary. The extracts will be run against a low-level calibration curve to produce the MRLs provided in Table A6-3.

PCB Congeners and Chlorinated Dioxins and Furans

PCB congeners and dioxins/furans in sediment samples will be analyzed using HRGC/HRMS. Dioxins/furans will be analyzed as described in the Round 2 QAPP. PCB congeners will be analyzed by Vista using the methods employed for Rounds 2 and 3 of the RI, as described below.

For PCB congener analysis, the sediment samples will be extracted with toluene by Soxhlet extraction. The cleanup procedures that will be used by the laboratory include back-extraction with sulfuric acid, acidic and basic silica gel column chromatography, and acidic alumina column chromatography. These procedures are expected to provide sufficient cleanup even for samples that contain high levels of interferents such as petroleum hydrocarbons. Vista will use a DB-1 (or equivalent) column rather than the more commonly used SPB-octyl column. This will allow the resolution of PCB 156 and PCB 157, which coelute on the SPB-octyl column. Although PCB 118, a dioxin-like congener, coelutes with PCB 106 on the DB-1 column, PCB 106 is not a significant constituent of any of the Aroclors. Therefore, the concentration of this coelution can be attributed wholly to PCB 118.

Vista will analyze 10 g of sample initially. If PCB 126 is not detected in a sample and if the sample matrix allows, the sample will be re-extracted and reanalyzed using a sample mass of up to 50 g. However, if other coplanar PCB congeners are detected and PCB 126 will not contribute significantly to the sediment's toxicity even if it is present at a level below the MDL, the sample will not be reanalyzed using a larger sample mass. A sample size of 10 g is expected to be sufficient to meet project detection limit goals for all of the coplanar PCB congeners except PCB 126. The collocated sediment samples will be analyzed for all 209 PCB congeners.

Detection limits for PCB congeners and chlorinated dioxins and furans are calculated on an individual compound and sample basis and depend on the signal-to-background ratio for the specific labeled isomer. The detection limits listed in Table A6-3 are based on MDL studies completed by Vista for each method and are expected to approximate the sample-specific detection limits for typical samples. Sample-specific detection limits will be reported in the database for coplanar PCB congeners and dioxins/furans when these analytes are not detected.

B4.2 Bulk Sediments - TCLP

Metals

Metals samples will be prepared using digestion with nitric and hydrochloric acids for analysis of metals other than mercury. Analysis for these metals will be completed by EPA method 6010B (ICP/AES) or EPA method 200.8 (ICP/MS). Mercury samples will be digested using sulfuric and nitric acid. Analysis will be performed using cold vapor atomic absorption (CVAA).

Organic Compounds

Volatiles will be analyzed following SW8260 as described in the Round 2 QAPP. Highly contaminated samples may be analyzed using medium-level methods (methanol extraction and analysis).

Semivolatiles will initially be screened to determine the level of extraction required for each sample. Clean samples will be extracted at an equivalent dry-weight mass of 7.5 g to 0.5 mL final volume for target detection limits between 67 and 670 µg/kg. Samples will be extracted using sonication, with GPC cleanup if necessary, and analyzed by GC/MS.

For pesticide analyses, an equivalent dry-weight mass of 12 g will be extracted and taken to a final volume of 4.0 mL after appropriate cleanup(s). Silica gel and sulfur cleanups will be performed to meet target detection limits of 1.7 to 3.3 µg/kg. Extracts will be analyzed by dual column gas chromatography electron capture detector (GC/ECD). The method will be modified by adding analysis of PCB interference check standards to the pesticide analysis to allow evaluation of the pesticide chromatograms for PCB interference, as requested in recent EPA Region 10 guidance for organochlorine pesticide analysis (EPA 2005).

For PCB Aroclor analyses, an equivalent dry-weight mass of 12 g will be extracted and taken to a final volume of 4.0 mL after appropriate acid, sulfur, and silica gel cleanup to meet the target reporting limit of 33 µg/kg. Extracts will be analyzed by dual column GC/ECD.

Herbicide samples will be extracted using methylene chloride/acetone and methylene chloride/hexane mixtures and an equivalent dry-weight mass of 15 g of sample. Herbicide esters are hydrolyzed to the acid form using a potassium hydroxide solution and back extracted with methylene chloride/acetone and methylene chloride/hexane mixtures, with a final extract volume of 50 mL. Extracts will be analyzed by dual column GC/ECD.

B4.3 Surface Water, MET Elutriates, SBLT Leachates

MET Elutriates

Elutriate samples extracted from the MET will be divided, and both total and dissolved fractions of all metals and organic compounds will be analyzed. Dissolved metals will be analyzed in samples that have been passed through a 0.45- μ m filter. To avoid the effects of adsorption onto the filter surface, dissolved organics will be analyzed in unfiltered samples that are instead prepared by centrifugation, consistent with recommended MET procedures.

SBLT Leachates

Both total and dissolved fractions of all constituents in the SBLT leachates will be analyzed. Leachates will be separated from the sediments by centrifugation. The leachate is then drawn off and analyzed for total constituents or filtered to recover dissolved constituents. In accordance with the USACE (2003) protocol, metals are filtered through a 0.45- μ m filter. To avoid adsorption onto the filter surface, organics are pre-filtered at 4 μ m then filtered through a 1- μ m glass fiber filter.

Conventional Analyses

Conventional analyses of surface water, MET elutriate, and SBLT leachate samples will include total suspended solids (TSS), total dissolved solids (TDS), TOC, dissolved organic carbon (DOC), total sulfides, and ammonia. EPA methods will be used as shown in Table A6-2. Conventional analyses will be conducted on the total fraction of MET elutriates and SBLT leachates.

TSS and TDS will be determined gravimetrically according to EPA methods 160.2 and 160.1, respectively. The laboratory will use a 0.45- μ m filter for these analyses.

TOC and DOC will be analyzed by EPA method 415.1. Organic carbon in the samples will be oxidized, and the evolved CO₂ will be analyzed using an infrared detector. Samples for DOC will be filtered in the field. Samples will be pretreated with sulfuric acid to remove inorganic carbon.

Total sulfides will be analyzed according to EPA method 376.2. The method is based upon the reaction of sulfide present in a sample with N,N-dimethyl-p-phenylenediamine and ferric chloride to form methylene blue. The color associated with ferric chloride can be removed by addition of di-ammonium hydrogen phosphate. Methylene blue color formation is directly proportional to the concentration of sulfide present in the sample.

Ammonia will be analyzed according to EPA method 350.1, using a continuous-flow analytical instrument. Within the instrument, alkaline phenol and hypochlorite react with ammonia in the sample to form indenophenol blue, which is proportional to the ammonia concentration. The blue color formed is intensified with sodium nitroprusside.

Metals

Three methods may be used to analyze surface water, elutriate, and leachate samples for total and dissolved metals (Table A6-4). Digestion with nitric and hydrochloric acids will be used to prepare samples for analysis of metals other than mercury. Analysis for these metals will be completed by EPA method 6010B (ICP/AES) or EPA method 200.8 (ICP/MS). Samples for analysis of arsenic will be concentrated by a factor of 10 prior to analysis as described above, if necessary.

Mercury samples will be digested using sulfuric acid and nitric acid. Analysis will be completed by CVAA.

Organic Compounds

Organochlorine pesticides will be extracted from samples using separatory funnel extraction procedures. Samples will be analyzed by dual column GC/ECD. Silica gel cleanup may be performed on the sample extracts. Pesticide detections will be confirmed at ARI by reverse search of the GC/MS data when concentrations are sufficiently high.

Separatory funnel extraction using ultra-clean hexane will be used for PCB Aroclor extraction. One liter of sample will be extracted. Acid cleanup will be performed on the sample extract followed by silica gel and sulfur cleanup. Samples will be analyzed for PCB Aroclors by dual column GC/ECD. The surrogate compounds, tetrachloro-*m*-xylene and decachlorobiphenyl, will be added to every sample and QC sample and to continuing calibration standards.

Sample extractions for phthalates and PAHs will be completed using continuous liquid-liquid or separatory funnel extraction. Analyses will be performed using SIM. Analyses for PAHs will be completed after silica gel cleanup if necessary.

PCB Congeners and Chlorinated Dioxins and Furans

Analyses for PCB congeners and chlorinated dioxins and furans will be completed by Vista. These analyses will be completed by HRGC/HRMS using isotope dilution methodology with multiple ¹³C labeled surrogate standards.

Cleanup procedures for chlorinated dioxins and furans will include sulfuric acid cleanup and silica/acid alumina and florisil column cleanup. Additional cleanup procedures will be used, as necessary, to remove analytical interferences. Detection limits for PCB congeners and chlorinated dioxins and furans are calculated on an individual compound and sample basis and depend on the signal-to-background ratio for the specific labeled isomer. The detection limits listed in Table A6-4 are based on MDL studies completed by Vista for each method and are expected to approximate the sample-specific detection limits for typical samples. Sample-specific detection limits will be reported in the database for PCB congeners and dioxins/furans when these analytes are not detected.

B4.4 TCLP Leachates

The TCLP leachate for metals and extractable organics will be created following EPA method 1311. Samples will be evaluated for choice of the proper buffered solution, and enough volume will be created to complete all the analyses listed.

The TCLP leachate for volatile analysis will be created by zero headspace extraction (ZHE).

Metals

Three methods may be used to analyze TCLP leachate samples for total metals (Table A6-6). Digestion with nitric and hydrochloric acids will be used to prepare samples for analysis of metals other than mercury. Analysis for these metals will be completed by EPA method 6010B (ICP/AES) or EPA method 200.8 (ICP/MS), or both.

Mercury samples will be digested using sulfuric acid and nitric acid. Analysis will be completed by CVAA.

Organic Compounds

Sample volumes will be reduced relative to standard volumes for all organic analyses except VOCs to minimize the volume of TCLP leachate needed for analysis. However, the leachate volume prepared and extracted for each analysis will be sufficient to meet the TCLP limits.

Herbicides will be extracted from samples using separatory funnel extraction procedures. Esters of the phenoxy acid herbicides in the sample will be hydrolyzed to the acid form by the addition of sodium hydroxide. The sample will then be acidified and the acid herbicides extracted using methylene chloride/acetone and methylene chloride/hexane mixtures. The acids will then be converted to their methyl esters using diazomethane. Extracts will be analyzed by dual column GC/ECD.

Organochlorine pesticides will be extracted from samples using separatory funnel extraction procedures. Samples will be analyzed by GC/ECD. Silica gel cleanup may be performed on the sample extracts. Pesticide detections will be confirmed at ARI by reverse search of the GC/MS data when concentrations are sufficiently high.

Semivolatile sample preparation will be completed using continuous liquid-liquid extraction or separatory funnel extraction. Tentatively identified compounds will not be reported. Analyses will be completed by GC/MS for target TCLP compounds only.

Volatiles leachates created using ZHE will be analyzed using purge-and-trap GC/MS for target TCLP compounds only.

B5 Quality Control

QC samples will be prepared in the field and at the laboratories to monitor the bias and precision of the sample collection and analysis procedures.

Field QC samples for this study will include the collection and analysis of field splits (i.e., an additional subsample of a given homogenized sample). Field splits will be collected for sediment samples as shown in Table B2-2. Field splits for surface water and sediment will be analyzed, but MET, SBLT, and TCLP will not be completed on the field splits.

Laboratory QC samples and control limits applicable for the analysis of sediment, surface water, MET elutriates, SBLT leachates, and TCLP leachates are presented in Tables A7-1 through and A7-4. Elutriate/leachate volumes may be restricted; therefore, at a minimum, ARI will prepare a preparation blank (per USACE methods) and ARI and Vista will analyze method blanks and laboratory control sample/laboratory control sample duplicates at a frequency of one for every 20 samples analyzed or per analytical batch, whichever is more frequent. If sufficient elutriate/leachate volume is present, matrix spikes/matrix spike duplicates will be included for organic analyses; and matrix spikes and matrix duplicates will be included for the metals analyses and conventional parameters, as appropriate.

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Table A4-1. Summary of Sample Types, Numbers, and Chemical Analyses.

Sample Type	Number of Individual Samples for Analysis ^a	Chemical Analyses ^b										
		Metals ^c	SVOCs ^d	PCB Aroclors	PCB Congeners	Chlorinated Pesticides	TPH	Dioxins /Furans	Sulfide	Ammonia	TCLP	Other ^f
											Analytes ^e	
Surface Water and Leachate Chemistry												
Site Surface Water for MET	11	9	6	9	9	6	7	4	2	2		11
MET Elutriate ^g	22	18	12	18	18	12	14	8	4	4		22
SBLT Leachate ^h	88	72	48	72	72	48	56	32	16	16		88
TCLP Leachate	11										11	
Total:	132											
Bulk Sediment Chemistry												
MET/SBLT	11	9	6	9	9	6	7	4	2	2		11
TCLP	11										11	
Total:	22											

Notes:

^a Field QC samples not included; see Table B2-2.

^b See FSP Table 4-2 for details about MET/SBLT bulk sediment samples and analyses. See FSP Table 4-4 for details about surface water, MET/SBLT elutriate, and TCLP leachate samples and analyses.

^c MET/SBLT bulk sediment, site water, MET elutriate, and SBLT leachate samples will be analyzed for metals that are iAOPC-specific, as shown in FSP Tables 4-2 and 4-4.

^d MET/SBLT bulk sediment, site water, MET elutriate, and SBLT leachate samples will be analyzed for iCOC SVOCs (i.e., phthalates and/or PAHs) that are iAOPC-specific, as shown in FSP Tables 4-2 and Table 4-4.

^e TCLP bulk sediment and leachates will be analyzed for the full list of TCLP analytes. See Tables A6-5 and A6-6 for the list of analytes for TCLP bulk sediment and leachate, respectively.

^f TOC, total solids, grain size, and specific gravity will be analyzed in all MET/SBLT bulk sediment samples. TSS, TDS, TOC and DOC will be analyzed in all surface water samples and MET elutriate and SBLT leachate samples.

^g These 11 MET elutriate samples will be analyzed for both total and dissolved constituents to yield 22 samples for the laboratory. Concentrations derived from filtered aliquots (for metals) and centrifuged aliquots (for organic compounds) will be reported by the laboratory as dissolved concentrations per the MET method.

^h Eleven SBLT tests yield a total of 44 leachate samples (i.e., four leachate samples per SBLT test), which will be analyzed for both total and dissolved constituents to yield a total of 88 samples for the laboratory. Concentrations derived from filtered aliquots (per the SBLT method) will be reported by the laboratory as dissolved concentrations.

MET - modified elutriate test

SBLT - sequential batch leachate test

TCLP - toxicity characteristic leaching procedure

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Table A4-2. Project Team Contact Information.

Name	Project Role	Phone	Fax	Email
EPA Region 10				
Chip Humphrey	Project Manager	503-326-2678	503-326-3399	humphrey.chip@epa.gov
Eric Blischke	Project Manager	503-326-4006	503-326-3399	blischke.eric@epamail.epa.gov
Dana Davoli	Human health risk assessment	206-553-2135	206 553-0119	davoli.dana@epa.gov
Joe Goulet	Ecological risk assessment	206-553-6692	206 553-0119	goulet.joe@epa.gov
Ginna Grepo-Grove	Quality Assurance Manager	206-553-1632	206-553-8210	Grepo-Grove.Gina@epamail.epa.gov
Lower Willamette Group				
Jim McKenna (Port of Portland)	Co-Chairman	503-944-7325	503-944-7353	mckenj@portptld.com
Bob Wyatt (Northwest Natural)	Co-Chairman	503-226-4211 x5425	503-273-4815	rjw@nwnatural.com
LWG Common Consultants				
Gene Revelas (Integral)	CERCLA Coordinator	360-705-3534	360-705-3669	grevelas@integral-corp.com
Nick Varum (Integral)	Sampling and Analysis Coordinator and Field QA Manager	503-284-5545 x12	503-284-5755	nvarum@integral-corp.com
Joss Moore (Integral)	Field Coordinator	503-284-5545 x17	503-284-5755	jmoore@integral-corp.com
Ross Pickering (Anchor)	Field Task Leader	206-287-9130	206-287-9131	rpickering@anchorenv.com
Maja Tritt (Integral)	Chemistry QA Manager	206-230-9600 x21	206-230-9601	mtritt@integral-corp.com
Tom Schulz (Integral)	Database Administrator	360-705-3534	360-705-3669	tschulz@integral-corp.com
Chemical Laboratories				
Sue Dunnihoo (ARI)	Laboratory Project Manager	206-695-6207	206-621-7523	sued@arilabs.com
Dave Mitchell (ARI)	Laboratory QA Manager	206-695-6205	206-621-7523	davem@arilabs.com
Martha Maier (Vista)	Laboratory Project Manager	916-673-1520	916-673-0106	mmaier@vista-analytical.com
Rose Harrelson (Vista)	Laboratory QA Manager	916-673-1520	916-673-0106	rharrelson@vista-analytical.com

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Table A6-1. Laboratory Methods for Sediment Samples.

Analysis	Sediment Type	Laboratory	Sample Preparation		Quantitative Analysis	
			Protocol	Procedure	Protocol	Procedure
Conventional Analyses		ARI				
Total solids	MET/SBLT		--	--	EPA 160.3/SM 2540B-97	Gravimetric
Grain size	MET/SBLT		--	--	PSEP 1986	Sieve and pipette method
Total organic carbon	MET/SBLT		Plumb 1981	Acid pretreatment	Plumb 1981	Combustion
Specific gravity	MET/SBLT		--	--	ASTM D-854	Gravimetric
Total sulfides	MET/SBLT		PSEP	Distillation	EPA 376.2/SM 4500-S2 D-00/F-00	Colorimetric
Ammonia	MET/SBLT		Plumb 1981	Potassium chloride extraction	EPA 350.1M	Colorimetric
Metals		ARI				
Arsenic, cadmium, silver, zinc	MET/SBLT		EPA 3050	Strong acid digestion	EPA 6010B and/or EPA 200.8	ICP/AES and/or ICP/MS
Arsenic, barium, cadmium, chromium, lead, selenium, silver	TCLP		EPA 3050	Strong acid digestion	EPA 6010B	ICP/AES
Mercury	All		EPA 7471A	Acid digestion/oxidation	EPA 7471A	CVA
Petroleum Hydrocarbons		ARI				
Diesel- and residual-range organics	MET/SBLT		NWTPH-Dx	Sovent extraction	NWTPH-Dx	GC/FID
Organochlorine Pesticides	All	ARI	EPA 3550B EPA 3610B EPA 3660B	Sonication extraction Alumina cleanup Sulfur cleanup	EPA 8081A	GC/ECD
Polycyclic Aromatic Hydrocarbons	MET/SBLT	ARI	EPA 3550B EPA 3630C	Sonication extraction Silica Gel cleanup	EPA 8270D-SIM	GC/MS-SIM
Phthalate Esters	MET/SBLT	ARI	EPA 3550B EPA 3640A	Sonication extraction Gel permeation chromatography	EPA 8270D-SIM	GC/MS-SIM
Semivolatile Organic Compounds	TCLP	ARI	EPA 3550B	Sonication extraction	EPA 8270D	GC/MS
PCB Aroclors	MET/SBLT	ARI	EPA 3550B EPA 3665A EPA 3630C EPA 3660B	Sonication extraction Sulfuric acid cleanup Silica Gel cleanup Sulfur cleanup	EPA 8082	GC/ECD
Volatile Organic Compounds	TCLP	ARI	EPA 5035	Purge and trap	EPA 8260C	GC/MS
Chlorinated Herbicides	TCLP	ARI	EPA 8151A	Solvent extraction Esterification	EPA 8151A	GC/ECD
PCB Congeners^a	MET/SBLT	Vista	EPA 1668A	Soxhlet/Dean Stark extraction Sulfuric acid cleanup Silica column cleanup	EPA 1668A	HRGC/HRMS

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Table A6-1. Laboratory Methods for Sediment Samples.

Analysis	Sediment Type	Laboratory	Sample Preparation		Quantitative Analysis	
			Protocol	Procedure	Protocol	Procedure
Chlorinated Dioxins and Furans	MET/SBLT	Vista	EPA 1613B	Soxhlet/Dean Stark extraction Sulfuric acid cleanup Silica/carbon column cleanup	EPA 1613B	HRGC/HRMS
Leaching Procedures						
Modified Elutriate Test (MET)	MET	ARI	USACE 2003	Elutriate test	NA	NA
Sequential Batch Leachate Test (SBLT)	SBLT	ARI	USACE 2003	Leaching test	NA	NA
Toxicity Characteristic Leaching Procedure (TCLP)	TCLP	ARI	EPA 1311	Leaching test	NA	NA

Notes:

* Analysis will be completed for all 209 PCB congeners

ARI - Analytical Resources, inc.

ASTM - American Society for Testing and Materials

CVAA - cold vapor atomic absorption spectrometry

EPA - U.S. Environmental Protection Agency

GC/ECD - gas chromatography/electron capture detection

GC/FID - gas chromatography/fluorescence ionization detection

GC/MS - gas chromatography/mass spectrometry

HRGC/HRMS - high-resolution gas chromatography/high-resolution mass spectrometry

ICP/AES - inductively coupled plasma/atomic emission spectrometry

ICP/MS - inductively coupled plasma - mass spectrometry

MET - modified elutriate test

PCB - polychlorinated biphenyl

PSEP - Puget Sound Estuary Program

SBLT - sequential batch leachate test

SIM - selected ion monitoring

SM - Standard Methods

TCLP - toxicity characteristic leaching procedure

USACE - U.S. Army Corps of Engineers

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Table A6-2. Laboratory Methods for Surface Water, MET Elutriate, SBLT Leachate, and TCLP Leachate Samples.

Analytes	Sample Type	Laboratory	Sample Preparation		Quantitative Analysis	
			Protocol	Procedure	Protocol	Procedure
Conventional Analyses		ARI				
Total suspended solids	SW/MET/SBLT		EPA 160.2/SM 2540D-97	Filtration and drying	EPA 160.2/SM 2540D-97	Balance
Total dissolved solids	SW/MET/SBLT		EPA 160.1/SM 2540C-97	Filtration and drying	EPA 160.1/SM 2540C-97	Balance
Total organic carbon	SW/MET/SBLT		EPA 415.1/SM 5310B-00	Chemical oxidation	EPA 415.1/SM 5310B-00	Infrared detector
Dissolved organic carbon	SW/MET/SBLT		EPA 415.1/SM 5310B-00	Filtration, chemical oxidation	EPA 415.1/SM 5310B-00	Infrared detector
Total sulfides	SW/MET/SBLT		EPA 376.2/SM 4500-S2 D-00/F-00	Methyl Thymol Blue	EPA 376.2/SM 4500-S2 D-00/F-00	Colorimetric
Ammonia	SW/MET/SBLT		EPA 350.1M	Automated Phenate	EPA 350.1M	Colorimetric
Metals		ARI				
Arsenic, cadmium, silver, zinc	SW/MET/SBLT		EPA 3005	Acid digestion	EPA 6010B/EPA 200.8	ICP/AES - ICP/MS
Arsenic, barium, cadmium, chromium, lead, selenium, silver	TCLP		EPA 3005	Acid digestion	EPA 6010B	ICP/AES
Mercury	All		EPA 7470A	Acid digestion/oxidation	EPA 7470A	CVAA
Petroleum Hydrocarbons		ARI				
Diesel- and residual-range organics	SW/MET/SBLT		NWTPH-Dx	Sovent extraction	NWTPH-Dx	GC/FID
PCB Aroclors	SW/MET/SBLT	ARI	EPA 3510C EPA 3665A EPA 3630C EPA 3660B	Separatory funnel extraction Sulfuric acid cleanup Silica Gel cleanup Sulfur cleanup	EPA 8082	GC/ECD
Organochlorine Pesticides	All	ARI	EPA 3510C EPA 3630C EPA 3660B	Separatory funnel extraction Silica Gel cleanup Sulfur cleanup	EPA 8081A	GC/ECD
Polycyclic Aromatic Hydrocarbons and Phthalates	SW/MET/SBLT	ARI	EPA 3520C EPA 3660B	Continuous liquid-liquid extraction Sulfur cleanup (as needed)	EPA 8270D-SIM	GC/MS-SIM
Semivolatile Organic Compounds	TCLP	ARI	EPA 3520C	Continuous liquid-liquid extraction	EPA 8270D	GC/MS
Volatile Organic Compounds	TCLP	ARI	EPA 5035	Purge and trap	EPA 8260C	GC/MS
Chlorinated Herbicides	TCLP	ARI	EPA 8151A	Solvent extraction Esterification	EPA 8151A	GC/ECD
Chlorinated Dioxins and Furans	SW/MET/SBLT	Vista	EPA 1613B	Layered Acid/Base/SiO ₃ column Florisil [®] cleanup Carbon/Celite clean-up column 1% deactivated basic Alumina	EPA 1613B	HRGC/HRMS

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Table A6-2. Laboratory Methods for Surface Water, MET Elutriate, SBLT Leachate, and TCLP Leachate Samples.

Analytes	Sample Type	Laboratory	Sample Preparation		Quantitative Analysis	
			Protocol	Procedure	Protocol	Procedure
PCB Congeners ^a	SW/MET/SBLT	Vista	EPA 1668A	Florisil [®] cleanup Extract fractionation Layered Acid/Base SiO ₂ Alumina	EPA 1668A	HRGC/HRMS

Notes:

^a Analysis will be completed for all 209 PCB congeners

ARI - Analytical Resources, inc.

CVAA - cold vapor atomic absorption spectrometry

EPA - U.S. Environmental Protection Agency

GC/ECD - gas chromatography/electron capture detection

GC/FID - gas chromatography/flammation ionization detection

GC/MS - gas chromatography/mass spectrometry

HRGC/HRMS - high-resolution gas chromatography/high-resolution mass spectrometry

ICP/AES - inductively coupled plasma/atomic emission spectrometry

ICP/MS - inductively coupled plasma - mass spectrometry

MET - modified elutriate test

PCB - polychlorinated biphenyl

SBLT - sequential batch leachate test

SIM - selected ion monitoring

SW- site surface water

SM - Standard Methods

TCLP - toxicity characteristic leaching procedure

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Table A6-3. Parameters, Method Reporting Limits, and Detection Limits for MET/SBLT Bulk Sediment Samples.

Analytes	ACG	Project Limits ^a		Laboratory Limits	
		MDL	MRL	MDL	MRL ^b
Conventional Analyses					
Total solids (percent of whole weight)	*	0.01	0.01	0.01	0.01
Grain size (percent) ^f	*	0.1	0.1	0.1	0.1
Total organic carbon (percent)	*	0.02	0.05	0.0122	0.02
Total sulfides (mg/kg)	*	0.1	0.2	0.068	1.0
Ammonia (mg/kg)	*	0.05	0.1	0.004	0.1
Specific gravity	*	--	0.01	--	0.01
Metals, mg/kg dry wt					
Arsenic	*	0.03	0.1	0.04	0.5
Cadmium	*	0.008	0.02	0.02	0.2
Mercury	*	0.006	0.02	0.005	0.05
Silver	*	0.02	0.02	0.01	0.20
Zinc	*	0.2	0.5	0.8	1.0
Petroleum Hydrocarbons, mg/kg dry wt					
Diesel-Range Organics	*	2.7	25	1.89	5
Residual-Range Organics	*	4.5	100	3.27	10
Organochlorine Pesticides, µg/kg dry wt					
2,4'-DDD	*	0.11	0.2	0.921	2.0
2,4'-DDE	*	0.12	0.2	0.917	2.0
2,4'-DDT	*	0.070	0.2	1.261	2.0
4,4'-DDD	0.083	0.060	0.2	0.417	2.0
4,4'-DDE	0.0588	0.050	0.2	0.548	2.0
4,4'-DDT	0.0588	0.032	0.2	0.646	2.0
Aldrin	0.00038	0.075	0.2	0.394	1.0
alpha-BHC	0.001	0.13	0.2	0.298	1.0
beta-BHC	0.0036	0.15	0.2	0.754	1.0
delta-BHC	*	0.028	0.2	0.404	1.0
gamma-BHC (Lindane)	0.005	0.075	0.2	0.410	1.0
alpha-Chlordane	*	0.12	0.2	0.247	1.0
gamma-Chlordane	*	0.032	0.2	0.356	1.0
Oxychlordane	*	0.029	0.2	0.874	2.0
cis -Nonachlor	*	0.036	0.2	1.133	2.0
trans -Nonachlor	*	0.033	0.2	0.891	2.0
Dieldrin	0.0004	0.15	0.2	0.516	2.0
Endosulfan I	1.7	0.085	0.2	0.334	1.0
Endosulfan II	*	0.10	0.2	0.501	2.0
Endosulfan sulfate	*	0.040	0.2	0.734	2.0
Endrin	0.084	0.10	0.2	0.494	2.0
Endrin aldehyde	*	0.027	0.2	1.111	2.0
Endrin ketone	*	0.041	0.2	0.802	2.0
Heptachlor	0.0014	0.040	0.2	0.331	1.0
Heptachlor epoxide	0.0007	0.065	0.2	0.181	1.0
Methoxychlor	1.4	0.050	0.2	5.458	10
Toxaphene	0.0059	4.5	20	48.1	100
Mirex	0.056	0.032	0.2	1.22	2.0
PCB Aroclors, µg/kg dry wt					
Aroclor 1016	*	1.6	10	1.12	10.0
Aroclor 1221	*	1.6	20	1.12	10.0
Aroclor 1232	*	1.6	10	1.12	10.0

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Table A6-3. Parameters, Method Reporting Limits, and Detection Limits for MET/SBLT Bulk Sediment Samples.

Analytes	ACG	Project Limits ^a		Laboratory Limits	
		MDL	MRL	MDL	MRL ^b
Aroclor 1242	0.004	1.6	10	1.12	10.0
Aroclor 1248	0.004	1.6	10	1.33	10.0
Aroclor 1254	0.004	1.6	10	1.33	10.0
Aroclor 1260	0.004	1.6	10	1.33	10.0
Aroclor 1262	*	1.6	10	1.33	10.0
Aroclor 1268	*	1.6	10	1.33	10.0
Polycyclic Aromatic Hydrocarbons, µg/kg dry wt					
2-Methylnaphthalene	*	0.11	5	1.20	6.7
Acenaphthene	72	0.23	5	4.29	6.7
Accenaphthylene	*	0.24	5	2.47	6.7
Anthracene	360	0.47	5	3.25	6.7
Benz(a)anthracene	0.038	0.48	5	6.18	6.7
Benzo(a)pyrene	0.0038	0.14	5	2.39	6.7
Benzo(b)fluoranthene	0.038	0.25	5	6.02	6.7
Benzo(g,h,i)perylene	*	0.64	5	3.45	6.7
Benzo(k)fluoranthene	0.38	0.15	5	5.88	6.7
Chrysene	3.8	0.25	5	2.74	6.7
Dibenz(a,h)anthracene	0.0038	0.59	5	5.59	6.7
Dibenzofuran	8.2	0.28	5	3.65	6.7
Fluoranthene	48	0.61	5	3.4	6.7
Fluorene	48	0.5	5	3.58	6.7
Indeno(1,2,3-cd)pyrene	0.038	0.16	5	3.39	6.7
Naphthalene	24	0.37	5	2.74	6.7
Phenanthrene	*	0.75	5	4.47	6.7
Pyrene	36	0.37	5	3.46	6.7
Semivolatile Organic Compounds, mg/kg dry wt					
<i>Phthalate Esters</i>					
Bis(2-ethylhexyl) phthalate	3.4	1.7	200	11	20
Butylbenzyl phthalate	400	1.5	10	11.2	20
Dibutyl phthalate	204	2.6	10	12.4	20
Diethyl phthalate	*	3.5	10	16.4	20
Dimethyl phthalate	20000	1.8	10	7.77	20
Di-n-octyl phthalate	40.9	1.2	10	8.34	20
Chlorinated Dioxins and Furans, pg/g dry wt^d					
2,3,7,8-TCDD	0.0001	0.08	0.2	0.04	0.5
2,3,7,8-TCDF	0.001	0.09	0.2	0.05	0.5
1,2,3,7,8-PeCDD	0.01	0.36	0.5	0.09	2.5
1,2,3,7,8-PeCDF	0.01	0.25	0.5	0.11	2.5
2,3,4,7,8-PeCDF	0.01	0.16	0.5	0.08	2.5
1,2,3,4,7,8-HxCDD	0.09	0.27	0.5	0.09	2.5
1,2,3,6,7,8-HxCDD	9.4	0.62	0.5	0.16	2.5
1,2,3,7,8,9-HxCDD	0.001	0.50	0.5	0.09	2.5
1,2,3,4,7,8-HxCDF	0.001	0.30	0.5	0.12	2.5
1,2,3,6,7,8-HxCDF	0.0002	0.37	0.5	0.11	2.5
1,2,3,7,8,9-HxCDF	0.01	0.28	0.5	0.09	2.5
2,3,4,6,7,8-HxCDF	0.01	0.29	0.5	0.12	2.5
1,2,3,4,6,7,8-HpCDD	0.01	0.27	0.5	0.16	2.5
1,2,3,4,6,7,8-HpCDF	0.01	0.39	0.5	0.08	2.5
1,2,3,4,7,8,9-HpCDF	0.09	0.42	0.5	0.06	2.5
OCDD	0.09	1.55	1.0	0.84	5.0
OCDF	9.4	4.04	1.0	0.20	5.0
Total tetrachlorinated dioxins	*	--	--	--	--

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Table A6-3. Parameters, Method Reporting Limits, and Detection Limits for MET/SBLT Bulk Sediment Samples.

Analytes	ACG	Project Limits ^a		Laboratory Limits	
		MDL	MRL	MDL	MRL ^b
Total pentachlorinated dioxins	*	--	--	--	--
Total hexachlorinated dioxins	*	--	--	--	--
Total heptachlorinated dioxins	*	--	--	--	--
Total tetrachlorinated furans	*	--	--	--	--
Total pentachlorinated furans	*	--	--	--	--
Total hexachlorinated furans	*	--	--	--	--
Total heptachlorinated furans	*	--	--	--	--
PCB Congeners, pg/g dry wt^{d,e,f}					
Dioxin-like PCB congeners (WHO list)					
PCB-77	10	1.08	5	0.28	5
PCB-81	10	1.02	5	0.22	5
PCB-105	10	0.92	5	0.35	5
PCB-114	2	0.73	5	0.30	5
PCB-118 (coelution with PCB 106)	10	2.14	5	0.72	5
PCB-123	10	0.86	5	0.41	5
PCB-126	0.01	0.63	5	0.22	5
PCB-156	2	0.82	5	0.57	5
PCB-157	2	0.55	5	0.27	5
PCB-167	100	0.49	5	0.41	5
PCB-169	0.1	0.77	5	0.35	5
PCB-170	*	0.41	5	0.29	5
PCB-180	*	0.68	5	0.32	5
PCB-189	10	0.29	5	0.35	5
187 Non-planar PCB congeners	*	0.2 - 29	25 - 75	0.2 - 29	2.5-5

Notes:

* A risk-based ACG has not been established.

^a Project limits refer to Round 2 QAPP Addendum 10 (Integral and Windward 2007) sediment values.

^b The MRL is provided on a dry-weight basis and assumes 50% moisture in the samples.

The MRL for project samples will vary with moisture content in the samples.

The MRL generally represents the level of lowest calibration standard (i.e., the practical quantitation limit).

^c Grain-size intervals will include the following:

Medium gravel	Fine sand	Very fine silt
Fine Gravel	Very fine sand	Clay, phi size 8-9
Very coarse sand	Coarse silt	Clay, phi size >9
Coarse sand	Medium silt	
Medium sand	Fine silt	

^d Expected MDLs are shown. MDLs for PCB congeners and dioxins and furans are sample-dependent and will vary from the indicated values.

^e Results for the WHO PCB congeners will be reported to sample-specific MDLs. Method modifications are described in Section B4.1 to improve detection limits if PCBs 126 or 169 are not detected in sediment samples.

^f Project limits refer to Round 2 QAPP Addendum 2 (Integral 2004) sediment

ACG - analytical concentration goals

MDL - method detection limit

MRL - method reporting limit

PCB - polychlorinated biphenyl

WHO - World Health Organization

Green highlight used when previous MDL/MRL is less than MDL/MRL for chemical mobility study.

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Table A6-4. Parameters, Method Reporting Limits, and Detection Limits for Surface Water, MET Elutriate, and SBLT Leachate Samples.

Analytes	Project Limits ^a		Laboratory Limits		AWQC Criteria	
	MDL	MRL	MDL	MRL ^b	Freshwater CCC	Water + Organism
Conventional Analyses, mg/L						
Total suspended solids	1.00	1.00	--	1.00	na	na
Total dissolved solids	na	na	--	10.00	na	na
Total organic carbon	0.07	0.5	0.147	1.50	na	na
Dissolved organic carbon	0.07	0.5	0.147	1.50	na	na
Total sulfides	na	na	0.026	0.05	0.002	na
Ammonia	na	na	0.004	0.01	na	na
Metals, ug/L						
Arsenic	na	0.05	0.05	0.20	150	0.018
Cadmium	0.01	0.02	0.02	0.20	0.25	5
Mercury	0.1	0.2	0.005	0.10	0.77	na
Silver	0.01	0.02	0.01	0.20	na	na
Zinc	0.2	0.5	1.05	4.00	120	7400
Petroleum Hydrocarbons, ug/L						
Diesel Range Organics (DRO)	na	na	6	25	na	na
Residual Range Organics (RRO)	na	na	5.1	50	na	na
Organochlorine Pesticides, ug/L						
2,4'-DDD	na	0.0005	*	0.01	na	na
2,4'-DDE	na	0.0005	*	0.01	na	na
2,4'-DDT	na	0.0005	*	0.01	na	na
4,4'-DDD	na	0.0005	0.00154	0.01	na	0.00031
4,4'-DDE	na	0.0005	0.00211	0.01	na	0.00022
4,4'-DDT	na	0.0005	0.00226	0.01	0.001	0.00022
Aldrin	na	0.0005	0.00155	0.005	na	0.000049
alpha-BHC	na	0.0005	0.00165	0.005	na	0.0026
beta-BHC	na	0.0005	0.00154	0.005	na	0.0091
delta-BHC	na	0.0005	0.00177	0.005	na	na
gamma-BHC (Lindane)	na	0.0005	0.00132	0.005	na	0.98
alpha-Chlordane	na	0.0005	0.00121	0.005	0.0043	0.0008
gamma-Chlordane	na	0.0005	0.00519	0.005	0.0043	0.0008
Oxychlordane	na	0.0005	*	0.01	na	na
cis-Nonachlor	na	0.0005	*	0.01	na	na
trans-Nonachlor	na	0.0005	*	0.01	na	na
Dieldrin	na	0.0005	0.00165	0.01	0.056	0.000052
Endosulfan I	na	0.0005	0.00109	0.005	0.056	62
Endosulfan II	na	0.0005	0.00171	0.01	0.056	62
Endosulfan sulfate	na	0.0005	0.00113	0.01	na	62
Endrin	na	0.0005	0.00197	0.01	0.036	0.059
Endrin aldehyde	na	0.0005	0.00275	0.01	na	0.29
Endrin ketone	na	0.0005	0.00331	0.01	na	na
Heptachlor	na	0.0005	0.00256	0.005	0.0038	0.000079
Heptachlor epoxide	na	0.0005	0.00168	0.005	0.0038	0.000039
Methoxychlor	na	0.0005	0.00892	0.05	na	na
Toxaphene	na	0.025	*	0.5	0.002	0.00028
Mirex	na	NE	*	0.01	0.001	na
PCB Aroclors, ug/L^c						
Total PCBs	--	--	--	--	0.014	0.000064
Aroclor 1016	na	0.0025	0.002	0.01	na	na
Aroclor 1221	na	0.0025	0.002	0.01	na	na
Aroclor 1232	na	0.0025	0.002	0.01	na	na
Aroclor 1242	na	0.0025	0.002	0.01	na	na
Aroclor 1248	na	0.00125	0.0014	0.01	na	na
Aroclor 1254	na	0.00125	0.0014	0.01	na	na

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Table A6-4. Parameters, Method Reporting Limits, and Detection Limits for Surface Water, MET Elutriate, and SBLT Leachate Samples.

Analytes	Project Limits ^a		Laboratory Limits		AWQC Criteria	
	MDL	MRL	MDL	MRL ^b	Freshwater CCC	Water + Organism
Aroclor 1260	na	0.0025	0.0014	0.01	na	na
Aroclor 1262	na	0.0025	0.0014	0.01	na	na
Aroclor 1268	na	0.0025	0.0014	0.01	na	na
Polycyclic Aromatic Hydrocarbons, ug/L						
2-Methylnaphthalene	0.012	0.02	0.00475	0.01	na	na
Acenaphthene	0.0097	0.02	0.00173	0.01	na	670
Acenaphthylene	0.0089	0.02	0.00225	0.01	na	na
Anthracene	0.01	0.02	0.00173	0.01	na	8300
Benz(a)anthracene	0.013	0.02	0.00195	0.01	na	0.0038
Benzo(a)pyrene	0.0087	0.02	0.00135	0.01	na	0.0038
Benzo(b)fluoranthene	0.0098	0.02	0.00165	0.01	na	0.0038
Benzo(g,h,i)perylene	0.009	0.02	0.00273	0.01	na	na
Benzo(k)fluoranthene	0.011	0.02	0.00358	0.01	na	0.0038
Chrysene	0.012	0.02	0.00191	0.01	na	0.0038
Dibenz(a,h)anthracene	0.0079	0.02	0.00139	0.01	na	0.0038
Dibenzofuran	na	na	0.00247	0.01	na	na
Fluoranthene	0.013	0.02	0.00141	0.01	na	130
Fluorene	0.011	0.02	0.00359	0.01	na	1100
Indeno(1,2,3-cd)pyrene	0.0087	0.02	0.00173	0.01	na	0.0038
Naphthalene	0.014	0.02	0.00712	0.01	na	na
Phenanthrene	0.013	0.02	0.00249	0.01	na	na
Pyrene	0.012	0.02	0.00233	0.01	na	830
Semivolatile Organic Compounds, ug/L						
<i>Phthalate Esters</i>						
Bis(2-ethylhexyl) phthalate	0.049	0.5	0.194	0.2	na	1.2
Butylbenzyl phthalate	0.013	0.5	0.022	0.1	na	1500
Dibutyl phthalate	0.013	0.5	0.112	0.2	na	2000
Diethyl phthalate	0.007	0.5	0.083	0.1	na	17000
Dimethyl phthalate	0.015	0.5	0.023	0.1	na	270000
Di-n-octyl phthalate	0.005	0.1	0.046	0.1	na	na
Chlorinated Dioxins and Furans, pg/L^d						
2,3,7,8-TCDD	na	na	0.56	5	na	na
2,3,7,8-TCDF	na	na	0.47	5	na	na
1,2,3,7,8-PeCDD	na	na	0.86	25	na	na
1,2,3,7,8-PeCDF	na	na	0.87	25	na	na
2,3,4,7,8-PeCDF	na	na	0.71	25	na	na
1,2,3,4,7,8-HxCDD	na	na	1.02	25	na	na
1,2,3,6,7,8-HxCDD	na	na	0.91	25	na	na
1,2,3,7,8,9-HxCDD	na	na	0.87	25	na	na
1,2,3,4,7,8-HxCDF	na	na	0.66	25	na	na
1,2,3,6,7,8-HxCDF	na	na	0.84	25	na	na
1,2,3,7,8,9-HxCDF	na	na	1.30	25	na	na
2,3,4,6,7,8-HxCDF	na	na	0.99	25	na	na
1,2,3,4,6,7,8-HpCDD	na	na	1.19	25	na	na
1,2,3,4,6,7,8-HpCDF	na	na	0.60	25	na	na
1,2,3,4,7,8,9-HpCDF	na	na	0.56	25	na	na
OCDD	na	na	1.87	50	na	na
OCDF	na	na	4.20	50	na	na

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Table A6-4. Parameters, Method Reporting Limits, and Detection Limits for Surface Water, MET Elutriate, and SBLT Leachate Samples.

Analytes	Project Limits ^a		Laboratory Limits		AWQC Criteria	
	MDL	MRL	MDL	MRL ^b	Freshwater CCC	Water + Organism
Total tetrachlorinated dioxins	--	--	--	--	na	na
Total pentachlorinated dioxins	--	--	--	--	na	na
Total hexachlorinated dioxins	--	--	--	--	na	na
Total heptachlorinated dioxins	--	--	--	--	na	na
Total tetrachlorinated furans	--	--	--	--	na	na
Total pentachlorinated furans	--	--	--	--	na	na
Total hexachlorinated furans	--	--	--	--	na	na
Total heptachlorinated furans	--	--	--	--	na	na
PCB Congeners, pg/L						
Dioxin-like PCB congeners (WHO list)					na	na
PCB-77	3.23	25	3.23	25	na	na
PCB-81	3.11	25	3.11	25	na	na
PCB-105	7.34	25	7.34	25	na	na
PCB-114	3.49	25	3.49	25	na	na
PCB-118 (coelution with PCB 106)	31.7	50	31.7	50	na	na
PCB-123	2.40	25	2.40	25	na	na
PCB-126	2.37	25	2.37	25	na	na
PCB-156	2.90	25	2.90	25	na	na
PCB-157	2.86	25	2.86	25	na	na
PCB-167	2.17	25	2.17	25	na	na
PCB-169	4.14	25	4.14	25	na	na
PCB-189	2.56	25	2.56	25	na	na
187 Non-planar PCB congeners	1.93 - 41.58	25 - 100	1.93 - 41.58	25 - 100	na	na

Notes:

^a Project limits are as provided for stormwater in Round 2 QAPP Addendum 8 (Integral 2007), except as noted.

^b The MRL generally represents the level of lowest calibration standard (i.e., the practical quantitation limit).

^c Project MRLs for Aroclors are as provided for surface water in QAPP Addendum 1. The method for surface water included extraction of 4 L of sample. For elutriate and leachate samples, 1 L will be extracted. The equivalent project MRL for a 1-L extraction is 4 times the indicated value and is similar to the MRL that will be used for the elutriate and leachate samples.

^d Project limits for dioxins/furans are available only for high-volume samples collected using XAD columns. These are not applicable to the chemical mobility test samples.

AWQC - EPA Ambient Water Quality Criteria

MDL - method detection limit

MET - modified elutriate test

MRL - method reporting limit

PCB - polychlorinated biphenyl

SBLT - sequential batch leachate test

na - not available

-- - not applicable

* An MDL study is in progress

MDL/MRL is less than Analytical Resources, Inc. (ARI) achievable MDL/MRL

ARI MDL/MRL exceeds AWQC Freshwater CCC criteria.

ARI MDL/MRL exceeds AWQC Water + Organism criteria.

ARI MDL/MRL exceeds both AWQC Freshwater CCC criteria and Water + Organism criteria.

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Table A6-5. Parameters, Method Reporting Limits, and Detection Limits for TCLP Bulk Sediment Analyses.

Parameter	Method Detection Limit	Method Reporting Limit
	(mg/kg)	(mg/kg)
Metals		
Arsenic	0.47	5.0
Barium	0.04	0.3
Cadmium	0.02	0.2
Chromium	0.16	0.5
Lead	0.16	2.0
Mercury	0.005	0.05
Selenium	0.63	5.0
Silver	0.03	0.3
Semivolatile Organic Compounds	(µg/kg)	(µg/kg)
2-Methylphenol (o-Cresol)	44.4	67
3-Methylphenol (m-Cresol, coelutes with 4-Methyl phenol)	-	-
4-Methylphenol (p-Cresol)	43.9	67
Cresol (sum of 2- and 4-Methyl phenol)	-	-
2,4-Dinitrotoluene	148	330
Hexachlorobenzene	22.4	67
Hexachlorobutadiene	22.7	67
Hexachloroethane	22.4	67
Nitrobenzene	21.5	67
Pentachlorophenol	131	330
Pyridine	210	330
2,4,5-Trichlorophenol	172	330
2,4,6-Trichlorophenol	156	330
Volatile Organic Compounds	(µg/kg)	(µg/kg)
Benzene	0.325	1.0
Chlorobenzene	0.372	1.0
Chloroform	0.370	1.0
Carbon Tetrachloride	0.467	1.0
1,4-Dichlorobenzene	0.094	1.0
1,2-Dichloroethane	0.37	1.0
1,1-Dichloroethene	0.428	1.0
2-Butanone (Methyl Ethyl Ketone)	1.228	5.0
Tetrachloroethene	0.423	1.0
Trichloroethene	0.335	1.0
Vinyl Chloride	0.772	1.0
Pesticides	(µg/kg)	(µg/kg)
Chlordane, alpha-	0.645	1.7
Chlordane, gamma-	0.638	1.7
Endrin	0.949	3.3
Heptachlor	0.803	1.7
Heptachlor epoxide	1.06	1.7
Lindane	0.794	1.7
Methoxychlor	7.568	17.0
Toxaphene	48.1	170
Herbicides	(µg/kg)	(µg/kg)
2,4,5-TP (Silvex)	3.41	8.3
2,4-D	13.8	33.0

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Table A6-6. Parameters, Method Reporting Limits, and Detection Limits for TCLP Leachate Samples.

Parameter	Method Detection Limit	Method Reporting Limit
Metals	mg/L	mg/L
Arsenic	0.024	0.2
Barium	0.0036	0.02
Cadmium	0.00075	0.01
Chromium	0.017	0.02
Lead	0.0046	0.1
Mercury	0.00004	0.0001
Selenium	0.024	0.2
Silver	0.002	0.02
Semivolatile Organic Compounds	ug/L	ug/L
2-Methylphenol (o-Cresol)	1.85	10
3-Methylphenol (m-Cresol, coelutes with 4-Methyl phenol)	-	-
4-Methylphenol (p-Cresol)	2.3	10
Cresol (sum of 2- and 4-Methyl phenol)	-	-
2,4-Dinitrotoluene	9.4	50
Hexachlorobenzene	2.2	10
Hexachlorobutadiene	3.2	10
Hexachloroethane	3.0	10
Nitrobenzene	1.9	10
Pentachlorophenol	2.2	50
Pyridine	1.6	50
2,4,5-Trichlorophenol	1.6	50
2,4,6-Trichlorophenol	1.2	50
Volatile Organic Compounds	ug/L	ug/L
Benzene	0.094	1.0
Chlorobenzene	0.053	1.0
Chloroform	0.094	1.0
Carbon Tetrachloride	0.082	1.0
1,4-Dichlorobenzene	0.121	1.0
1,2-Dichloroethane	0.084	1.0
1,1-Dichloroethene	0.094	1.0
2-Butanone (Methyl Ethyl Ketone)	1.55	5.0
Tetrachloroethene	0.097	1.0
Trichloroethene	0.102	1.0
Vinyl Chloride	0.116	1.0
Pesticides	ug/L	ug/L
Chlordane, alpha-	0.13	0.5
Chlordane, gamma-	0.08	0.5
Endrin	0.78	1.0
Heptachlor	0.11	0.5
Heptachlor epoxide	0.09	0.5
Lindane	0.08	0.5
Methoxychlor	0.87	5.0
Toxaphene	-	50
Herbicides	ug/L	ug/L
2,4,5-TP (Silvex)	1.2	1.2
2,4-D	1.98	5.0

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Table A7-1. Laboratory Control Limits for Surrogate Recoveries in Sediment Samples.

Surrogate Compound	Control Limits for Percent Recovery
ARI	
Petroleum Hydrocarbons	
n-Triacontane	50-150
o-Terphenyl	42-112
Organochlorine Pesticides	
Tetrachloro-meta-xylene	43 - 128
Decachlorobiphenyl	52 - 143
PCB Aroclors	
Tetrachloro-meta-xylene	48-123
Decachlorobiphenyl	43-148
Polycyclic Aromatic Hydrocarbons	
2-Methylnaphthalene-d10	37-106
Dibenzo(a,h)anthracene-d14	16-118
Semivolatile Organic Compounds	
2,4,6-Tribromophenol	25-103
2-Fluorobiphenyl	32-88
2-Fluorophenol	10-114
Nitrobenzene-d5	29-87
Phenol-d5	29-85
Terphenyl-d14	21-97
Volatile Organic Compounds	
1,2-Dichlorobenzene-d4	79 - 120
1,2-Dichloroethane-d4	72 - 134
4-Bromofluorobenzene	66 - 120
Dibromofluoromethane	30 - 160
Toluene-d8	78 - 124
Herbicides	
2,4-Dichlorophenylacetic acid	40 - 135
Vista	
Dioxins and Furans	
¹³ C-2,3,7,8-TCDD	40-135
¹³ C-1,2,3,7,8-PeCDD	40-135
¹³ C-1,2,3,4,7,8-HxCDD	40-135
¹³ C-1,2,3,6,7,8-HxCDD	40-135
¹³ C-1,2,3,4,6,7,8-HpCDD	40-135
¹³ C-OCDD	40-135
¹³ C-2,3,7,8-TCDF	40-135
¹³ C-1,2,3,7,8-PeCDF	40-135
¹³ C-2,3,4,7,8-PeCDF	40-135
¹³ C-1,2,3,4,7,8-HxCDF	40-135
¹³ C-1,2,3,6,7,8-HxCDF	40-135
¹³ C-2,3,4,6,7,8-HxCDF	40-135
¹³ C-1,2,3,4,6,7,8-HpCDF	40-135
¹³ C-1,2,3,4,7,8,9-HpCDF	40-135
PCB Congeners	
¹³ C-2-MonoCB	25-150
¹³ C-4-MonoCB	25-150
¹³ C-2,2'-DiCB	25-150
¹³ C-2,5-DiCB	25-150
¹³ C- 2,2',6-TriCB	25-150

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Table A7-1. Laboratory Control Limits for Surrogate Recoveries in Sediment Samples.

Surrogate Compound	Control Limits for Percent Recovery
¹³ C-2,4,4'-TriCB	25-150
¹³ C-2,4',6'-TriCB	25-150
¹³ C-3,4,4'-TriCB	25-150
¹³ C-2,2',5,5'-TetraCB	25-150
¹³ C-2,2',6,6'-TetraCB	25-150
¹³ C-3,3',4,4'-TetraCB	25-150
¹³ C-3,3',4,4'-TetraCB	25-150
¹³ C-2,2',3,5',6-PentaCB	25-150
¹³ C-2,2',4,5,5'-PentaCB	25-150
¹³ C-2,2',4,6,6'-PentaCB	25-150
¹³ C-2,3,3',4,4'-PentaCB	25-150
¹³ C-2,3,4,4',5-PentaCB	25-150
¹³ C-2,3',4,4',5-PentaCB	25-150
¹³ C-2',3,4,4',5-PentaCB	25-150
¹³ C-3,3',4,4',5-PentaCB	25-150
¹³ C-2,2',4,4',5,5'-HexaCB	25-150
¹³ C-2,2',4,4',6,6'-HexaCB	25-150
¹³ C-2,3,3',4,4',5-HexaCB	25-150
¹³ C-2,3,3',4,4',5'-HexaCB	25-150
¹³ C-2,3',4,4',5,5'-HexaCB	25-150
¹³ C-3,3',4,4',5,5'-HexaCB	25-150
¹³ C-2,2',3,3',4,4',5-HeptaCB	25-150
¹³ C-2,2',3,3',5,5',6-HeptaCB	25-150
¹³ C-2,2',3,4,4',5,5'-HeptaCB	25-150
¹³ C-2,2',3,4',5,6,6'-HeptaCB	25-150
¹³ C-2,3,3',4,4',5,5'-HeptaCB	25-150
¹³ C-2,2',3,3',4,4',5,5'-OctaCB	25-150
¹³ C-2,2',3,3',5,5',6,6'-OctaCB	25-150
¹³ C-2,2',3,3',4,4',5,5',6-NonaCB	25-150
¹³ C-2,2',3,3',4,5,5',6,6'-NonaCB	25-150
¹³ C-DecaCB	25-150

Notes:

Control limits are updated periodically by the laboratories. Control limits that are in effect at the laboratory at the time of analysis will be used for sample analysis and data validation. These may differ slightly from the control limits shown in this table.

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Table A7-2. Laboratory Control Limits for Surrogate Recoveries in Surface Water, MET Elutriate, SBLT Leachate, and TCLP Leachate Samples.

Surrogate Compound	Control Limits for Percent Recovery
ARI	
Petroleum Hydrocarbons	
n-Triacontane	50-150
o-Terphenyl	36-120
Organochlorine Pesticides	
Tetrachloro-meta-xylene	33-110
Decachlorobiphenyl	29-125
PCB Aroclors	
Tetrachloro-meta-xylene	30-98
Decachlorobiphenyl	19-121
Polycyclic Aromatic Hydrocarbons	
2-Methylnaphthalene-d10	40-114
Dibenzo(a,h)anthracene-d14	17-122
Semivolatile Organic Compounds	
2,4,6-Tribromophenol	30-160
2-Fluorobiphenyl	30-160
2-Fluorophenol	30-160
Nitrobenzene-d5	30-160
Phenol-d6	30-160
Terphenyl-d14	30-160
Volatile Organic Compounds	
1,2-Dichlorobenzene-d4	80 - 121
1,2-Dichloroethane-d4	64 - 146
4-Bromofluorobenzene	71 - 120
Dibromofluoromethane	30 - 160
Toluene-d8	78 - 125
Herbicides	
2,4-Dichlorophenylacetic acid	51 - 118
Vista	
Dioxins and Furans	
¹³ C-2,3,7,8-TCDD	25-164
¹³ C-1,2,3,7,8-PeCDD	25-181
¹³ C-1,2,3,4,7,8-HxCDD	32-141
¹³ C-1,2,3,6,7,8-HxCDD	28-130
¹³ C-1,2,3,4,6,7,8-HpCDD	23-140
¹³ C-OCDD	17-157
¹³ C-2,3,7,8-TCDF	24-169
¹³ C-1,2,3,7,8-PeCDF	24-185
¹³ C-2,3,4,7,8-PeCDF	21-178
¹³ C-1,2,3,4,7,8-HxCDF	26-152
¹³ C-1,2,3,6,7,8-HxCDF	26-123
¹³ C-2,3,4,6,7,8-HxCDF	28-136
¹³ C-1,2,3,4,6,7,8-HpCDF	28-143
¹³ C-1,2,3,4,7,8,9-HpCDF	26-138

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Table A7-2. Laboratory Control Limits for Surrogate Recoveries in Surface Water, MET Elutriate, SBLT Leachate, and TCLP Leachate Samples.

Surrogate Compound	Control Limits for Percent Recovery
PCB Congeners	
¹³ C-2-MonoCB	25-150
¹³ C-4-MonoCB	25-150
¹³ C-2,2'-DiCB	25-150
¹³ C-2,5-DiCB	25-150
¹³ C- 2,2',6-TriCB	25-150
¹³ C-2,4,4'-TriCB	25-150
¹³ C-2,4',6-TriCB	25-150
¹³ C-3,4,4'-TriCB	25-150
¹³ C-2,2',5,5'-TetraCB	25-150
¹³ C-2,2',6,6'-TetraCB	25-150
¹³ C-3,3',4,4'-TetraCB	25-150
¹³ C-3,3',4,4'-TetraCB	25-150
¹³ C-2,2',3,5',6-PentaCB	25-150
¹³ C-2,2',4,5,5'-PentaCB	25-150
¹³ C-2,2',4,6,6'-PentaCB	25-150
¹³ C-2,3,3',4,4'-PentaCB	25-150
¹³ C-2,3,4,4',5-PentaCB	25-150
¹³ C-2,3',4,4',5-PentaCB	25-150
¹³ C-2',3,4,4',5-PentaCB	25-150
¹³ C-3,3',4,4',5-PentaCB	25-150
¹³ C-2,2',4,4',5,5'-HexaCB	25-150
¹³ C- 2,2',4,4',6,6'-HexaCB	25-150
¹³ C-2,3,3',4,4',5-HexaCB	25-150
¹³ C-2,3,3',4,4',5'-HexaCB	25-150
¹³ C-2,3',4,4',5,5'-HexaCB	25-150
¹³ C-3,3',4,4',5,5'-HexaCB	25-150
¹³ C-2,2',3,3',4,4',5-HeptaCB	25-150
¹³ C-2,2',3,3',5,5',6-HeptaCB	25-150
¹³ C-2,2',3,4,4',5,5'-HeptaCB	25-150
¹³ C- 2,2',3,4',5,6,6'-HeptaCB	25-150
¹³ C- 2,3,3',4,4',5,5'-HeptaCB	25-150
¹³ C-2,2',3,3',4,4',5,5'-OctaCB	25-150
¹³ C-2,2',3,3',5,5',6,6'-OctaCB	25-150
¹³ C-2,2',3,3',4,4',5,5',6-NonaCB	25-150
¹³ C-2,2',3,3',4,5,5',6,6'-NonaCB	25-150
¹³ C-DecaCB	25-150

Notes:

Control limits are updated periodically by the laboratories. Control limits that are in effect at the laboratory at the time of analysis will be used for sample analysis and data validation. These may differ slightly from the control limits shown in this table.

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Table A7-3. Laboratory Control Limits for Matrix Spike and Laboratory Control Samples in Sediment Samples.

Analysis	Accuracy		Precision	
	Matrix Spike Recovery (percent)	LCS Recovery (percent)	Type of Duplicate	Control Limit RPD
ARI				
Conventional Analyses				
Grain size	NA	NA	Triplicate	10 ^a
Specific gravity	NA	NA	LD	20
Total organic carbon	75-125	85-115	LD	20
Total solids	NA	NA	LD	20
Total sulfides	75-125	85-115	LD	20
Ammonia	75-125	85-115	LD	20
Metals				
Arsenic	75-125	80-120	LD	20
Barium	75-125	80-120	LD	20
Cadmium	75-125	80-120	LD	20
Chromium	75-125	80-120	LD	20
Lead	75-125	80-120	LD	20
Mercury	75-125	80-120	LD	20
Selenium	75-125	80-120	LD	20
Silver	75-125	80-120	LD	20
Zinc	75-125	80-120	LD	20
Petroleum Hydrocarbons				
Diesel range organics (DRO)	48 - 100	48 - 100	LD	40
Residual range organics (RRO)	60-140	60-120	LD	40
Organochlorine Pesticides				
2,4'-DDD	30-160	30-160	MSD	40
2,4'-DDE	30-160	30-160	MSD	40
2,4'-DDT	30-160	30-160	MSD	40
4,4'-DDD	59-125	59-125	MSD	40
4,4'-DDE	58-126	58-126	MSD	40
4,4'-DDT	65-125	65-125	MSD	40
Aldrin	57-124	57-124	MSD	40
alpha-BHC	51-118	51-118	MSD	40
alpha-Chlordane	60-119	60-119	MSD	40
beta-BHC	57-122	57-122	MSD	40
cis-Nonachlor	30-160	30-160	MSD	40
delta-BHC	53-121	53-121	MSD	40
Dieldrin	57-123	57-123	MSD	40
Endosulfan I	42-148	42-148	MSD	40
Endosulfan II	55-126	55-126	MSD	40
Endosulfan sulfate	52-119	52-119	MSD	40
Endrin	57-124	57-124	MSD	40
Endrin aldehyde	25-103	25-103	MSD	40
Endrin ketone	50-129	50-129	MSD	40
gamma-BHC (Lindane)	58-117	58-117	MSD	40
gamma-Chlordane	58-122	58-122	MSD	40
Heptachlor	60-124	60-124	MSD	40
Heptachlor epoxide	62-121	62-121	MSD	40
Hexachlorobenzene	30-160	30-160	MSD	40
Hexachlorobutadiene	30-160	30-160	MSD	40
Hexachloroethane	30-160	30-160	MSD	40
Methoxychlor	51-128	51-128	MSD	40
Mirex	30-160	30-160	MSD	40
Oxychlordane	30-160	30-160	MSD	40
Toxaphene	30-160	30-160	MSD	40
trans-Nonachlor	30-160	30-160	MSD	40
PCB Aroclors				
Aroclor 1016	57-101	57-101	MSD	40
Aroclor 1260	57-126	57-126	MSD	40

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Table A7-3. Laboratory Control Limits for Matrix Spike and Laboratory Control Samples in Sediment Samples.

Analysis	Accuracy		Precision	
	Matrix Spike Recovery (percent)	LCS Recovery (percent)	Type of Duplicate	Control Limit RPD
Polycyclic Aromatic Hydrocarbons				
2-Methylnaphthalene	44-96	44-96	MSD	40
Acenaphthene	44-98	44-98	MSD	40
Acenaphthylene	41-99	41-99	MSD	40
Anthracene	48-103	48-103	MSD	40
Benz(a)anthracene	51-111	51-111	MSD	40
Benzo(a)pyrene	52-110	52-110	MSD	40
Benzo(b)fluoranthene	54-116	54-116	MSD	40
Benzo(g,h,i)perylene	36-118	36-118	MSD	40
Benzo(k)fluoranthene	55-114	55-114	MSD	40
Chrysene	54-109	54-109	MSD	40
Dibenz(a,h)anthracene	42-117	42-117	MSD	40
Dibenzofuran	46-96	46-96	MSD	40
Fluoranthene	53-120	53-120	MSD	40
Fluorene	47-101	47-101	MSD	40
Indeno(1,2,3-cd)pyrene	40-117	40-117	MSD	40
Naphthalene	39-99	39-99	MSD	40
Phenanthrene	47-106	47-106	MSD	40
Pyrene	50-107	50-107	MSD	40
Semivolatile Organic Compounds				
<i>Phthalate esters</i>				
Bis(2-ethylhexyl) phthalate	30-160	30-160	MSD	40
Butyl benzyl phthalate	30-160	30-160	MSD	40
Dibutyl phthalate	30-160	30-160	MSD	40
Diethyl phthalate	30-160	30-160	MSD	40
Dimethyl phthalate	30-160	30-160	MSD	40
Di-n-octyl phthalate	30-160	30-160	MSD	40
<i>Additional SVOCs</i>				
2,4,5-Trichlorophenol	47 - 97	47 - 97	MSD	40
2,4,6-Trichlorophenol	44 - 98	44 - 98	MSD	40
2,4-Dinitrotoluene	10 - 198	10 - 198	MSD	40
2-Methylphenol	48 - 91	48 - 91	MSD	40
4-Methylphenol	51 - 94	51 - 94	MSD	40
Hexachlorobenzene	52 - 96	52 - 96	MSD	40
Hexachlorobutadiene	36 - 91	36 - 91	MSD	40
Hexachloroethane	39 - 78	39 - 78	MSD	40
Nitrobenzene	47 - 85	47 - 85	MSD	40
Pentachlorophenol	34 - 107	34 - 107	MSD	40
Pyridine	30-160	30-160	MSD	40
Volatile Organic Compounds				
1,1-Dichloroethene	73 - 135	73 - 135	MSD	40
1,2-Dichloroethane	80 - 124	80 - 124	MSD	40
1,4-Dichlorobenzene	80 - 126	80 - 126	MSD	40
2-Butanone (Methyl Ethyl Ketone)	73 - 125	73 - 125	MSD	40
Benzene	80 - 126	80 - 126	MSD	40
Carbon Tetrachloride	76 - 136	76 - 136	MSD	40
Chlorobenzene	80 - 124	80 - 124	MSD	40
Chloroform	80 - 125	80 - 125	MSD	40
Tetrachloroethene	80 - 137	80 - 137	MSD	40
Trichloroethene	80 - 129	80 - 129	MSD	40
Vinyl Chloride	62 - 132	62 - 132	MSD	40
Herbicides				
2,4,5-TP (Silvex)	11 - 169	11 - 169	MSD	40
2,4-D	34 - 104	34 - 104	MSD	40

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Table A7-3. Laboratory Control Limits for Matrix Spike and Laboratory Control Samples in Sediment Samples.

Analysis	Accuracy		Precision	
	Matrix Spike Recovery (percent)	LCS Recovery (percent)	Type of Duplicate	Control Limit RPD
<i>Vista</i>				
Chlorinated Dioxins and Furans				
1,2,3,4,6,7,8-HpCDD	50-150	50-150	LCSD	50
1,2,3,4,6,7,8-HpCDF	50-150	50-150	LCSD	50
1,2,3,4,7,8,9-HpCDF	50-150	50-150	LCSD	50
1,2,3,4,7,8-HxCDD	50-150	50-150	LCSD	50
1,2,3,4,7,8-HxCDF	50-150	50-150	LCSD	50
1,2,3,6,7,8-HxCDD	50-150	50-150	LCSD	50
1,2,3,6,7,8-HxCDF	50-150	50-150	LCSD	50
1,2,3,7,8,9-HxCDD	50-150	50-150	LCSD	50
1,2,3,7,8,9-HxCDF	50-150	50-150	LCSD	50
1,2,3,7,8-PeCDD	50-150	50-150	LCSD	50
1,2,3,7,8-PeCDF	50-150	50-150	LCSD	50
2,3,4,6,7,8-HxCDF	50-150	50-150	LCSD	50
2,3,4,7,8-PeCDF	50-150	50-150	LCSD	50
2,3,7,8-TCDD	50-150	50-150	LCSD	50
2,3,7,8-TCDF	50-150	50-150	LCSD	50
OCDD	50-150	50-150	LCSD	50
OCDF	50-150	50-150	LCSD	50
Total heptachlorinated dioxins	--	--	LCSD	50
Total heptachlorinated furans	--	--	LCSD	50
Total hexachlorinated dioxins	--	--	LCSD	50
Total hexachlorinated furans	--	--	LCSD	50
Total pentachlorinated dioxins	--	--	LCSD	50
Total pentachlorinated furans	--	--	LCSD	50
Total tetrachlorinated dioxins	--	--	LCSD	50
Total tetrachlorinated furans	--	--	LCSD	50
PCB Congeners				
Dioxin-like PCB congeners (WHO list)	NA	50-150	LD	50
PCB-77	NA	50-150	LD	50
PCB-81	NA	50-150	LD	50
PCB-105	NA	50-150	LD	50
PCB-114	NA	50-150	LD	50
PCB-118	NA	50-150	LD	50
PCB-123	NA	50-150	LD	50
PCB-126	NA	50-150	LD	50
PCB-156	NA	50-150	LD	50
PCB-157	NA	50-150	LD	50
PCB-167	NA	50-150	LD	50
PCB-169	NA	50-150	LD	50
PCB-170	NA	50-150	LD	50
PCB-180	NA	50-150	LD	50
PCB-189	NA	50-150	LD	50
187 non-planar PCB congeners	NA	50-150	LD	50

Notes:

* RPD control limit is not applicable for grain size. Laboratory control limit is ± 10 percent in the weight of the fraction.

LCS - laboratory control sample	MSD - matrix spike duplicate
LCSD - laboratory control sample duplicate	NA - Not applicable
LD - laboratory duplicate	RPD - relative percent difference

Control limits are updated periodically by the laboratories. Control limits that are in effect at the laboratory at the time of analysis will be used for sample analysis and data validation. These may differ slightly from the control limits shown in this table.

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Table A7-4. Laboratory Control Limits for Matrix Spike and Laboratory Control Samples in Surface Water, MET Elutriate, SBLT Leachate, and TCLP Leachate Samples.

Analysis	Accuracy		Precision	
	Matrix Spike ^a Recovery (percent)	LCS Recovery (percent)	Type of Duplicate ^b	Control Limit RPD
ARI				
Conventional Analyses				
Total organic carbon	75-125	85-115	LD/LCSD	20
Total suspended solids	NA	NA	LD/LCSD	20
Total sulfides	60-130	60-130	LD/LCSD	20
Ammonia	75-125	85-115	LD/LCSD	20
Metals				
Arsenic	75-125	80-120	LD/LCSD	20
Barium	75-125	80-120	LD/LCSD	20
Cadmium	75-125	80-120	LD/LCSD	20
Chromium	75-125	80-120	LD/LCSD	20
Lead	75-125	80-120	LD/LCSD	20
Mercury	75-125	80-120	LD/LCSD	20
Selenium	75-125	80-120	LD/LCSD	20
Silver	75-125	80-120	LD/LCSD	20
Zinc	75-125	80-120	LD/LCSD	20
Petroleum Hydrocarbons				
Diesel range organics (DRO)	61 - 98	61 - 98	LD/LCSD	40
Residual range organics (RRO)	60-140	60-120	LD/LCSD	40
Organochlorine Pesticides				
2,4'-DDD	30-160	30-160	MSD/LCSD	40
2,4'-DDE	30-160	30-160	MSD/LCSD	40
2,4'-DDT	30-160	30-160	MSD/LCSD	40
4,4'-DDD	47-132	47-132	MSD/LCSD	40
4,4'-DDE	51-136	51-136	MSD/LCSD	40
4,4'-DDT	49-132	49-132	MSD/LCSD	40
Aldrin	48-111	48-111	MSD/LCSD	40
alpha-BHC	35-108	35-108	MSD/LCSD	40
alpha-Chlordane	45-130	45-130	MSD/LCSD	40
beta-BHC	49-124	49-124	MSD/LCSD	40
cis-Nonachlor	30-160	30-160	MSD/LCSD	40
delta-BHC	10-114	10-114	MSD/LCSD	40
Dieldrin	45-134	45-134	MSD/LCSD	40
Endosulfan I	39-135	39-135	MSD/LCSD	40
Endosulfan II	41-140	41-140	MSD/LCSD	40
Endosulfan sulfate	44-109	44-109	MSD/LCSD	40
Endrin	37-147	37-147	MSD/LCSD	40
Endrin aldehyde	34-126	34-126	MSD/LCSD	40
Endrin ketone	48-129	48-129	MSD/LCSD	40
gamma-BHC (Lindane)	43-120	43-120	MSD/LCSD	40
gamma-Chlordane	42-133	42-133	MSD/LCSD	40
Heptachlor	48-118	48-118	MSD/LCSD	40
Heptachlor epoxide	41-134	41-134	MSD/LCSD	40
Hexachlorobenzene	30-160	30-160	MSD/LCSD	40
Hexachlorobutadiene	30-160	30-160	MSD/LCSD	40
Hexachloroethane	30-160	30-160	MSD/LCSD	40
Methoxychlor	51-136	51-136	MSD/LCSD	40
Mirex	30-160	30-160	MSD/LCSD	40
Oxychlordane	30-160	30-160	MSD/LCSD	40
Toxaphene	30-160	30-160	MSD/LCSD	40
trans-Nonachlor	30-160	30-160	MSD/LCSD	40
PCB Aroclors				
Aroclor 1016	36-110	36-110	MSD/LCSD	40
Aroclor 1260	45-123	45-123	MSD/LCSD	40

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Table A7-4. Laboratory Control Limits for Matrix Spike and Laboratory Control Samples in Surface Water, MET Elutriate, SBLT Leachate, and TCLP Leachate Samples.

Analysis	Accuracy		Precision	
	Matrix Spike ^a Recovery (percent)	LCS Recovery (percent)	Type of Duplicate ^b	Control Limit RPD
Polycyclic Aromatic Hydrocarbons				
2-Methylnaphthalene	30-160	30-160	MSD/LCSD	40
Acenaphthene	41-111	41-111	MSD/LCSD	40
Acenaphthylene	38-108	38-108	MSD/LCSD	40
Anthracene	38-106	38-106	MSD/LCSD	40
Benz(a)anthracene	44-112	44-112	MSD/LCSD	40
Benzo(a)pyrene	39-127	39-127	MSD/LCSD	40
Benzo(b)fluoranthene	40-122	40-122	MSD/LCSD	40
Benzo(g,h,i)perylene	40-119	40-119	MSD/LCSD	40
Benzo(k)fluoranthene	39-127	39-127	MSD/LCSD	40
Chrysene	44-126	44-126	MSD/LCSD	40
Dibenz(a,h)anthracene	44-109	44-109	MSD/LCSD	40
Dibenzofuran	33-116	33-116	MSD/LCSD	40
Fluoranthene	46-123	46-123	MSD/LCSD	40
Fluorene	45-118	45-118	MSD/LCSD	40
Indeno(1,2,3-cd)pyrene	44-110	44-110	MSD/LCSD	40
Naphthalene	30-109	30-109	MSD/LCSD	40
Phenanthrene	49-118	49-118	MSD/LCSD	40
Pyrene	40-124	40-124	MSD/LCSD	40
Phthalate esters				
Bis(2-ethylhexyl) phthalate	30-160	30-160	MSD/LCSD	40
Butyl benzyl phthalate	30-160	30-160	MSD/LCSD	40
Dibutyl phthalate	30-160	30-160	MSD/LCSD	40
Diethyl phthalate	30-160	30-160	MSD/LCSD	40
Dimethyl phthalate	30-160	30-160	MSD/LCSD	40
Di-n-octyl phthalate	30-160	30-160	MSD/LCSD	40
Additional SVOCs				
2,4,5-Trichlorophenol	57 - 110	57 - 110	MSD	40
2,4,6-Trichlorophenol	44 - 116	44 - 116	MSD	40
2,4-Dinitrotoluene	53 - 118	53 - 118	MSD	40
2-Methylphenol	55 - 104	55 - 104	MSD	40
4-Methylphenol	55 - 109	55 - 109	MSD	40
Hexachlorobenzene	57 - 107	57 - 107	MSD	40
Hexachlorobutadiene	10 - 96	10 - 96	MSD	40
Hexachloroethane	10 - 82	10 - 82	MSD	40
Nitrobenzene	56 - 103	56 - 103	MSD	40
Pentachlorophenol	34 - 126	34 - 126	MSD	40
Pyridine	60-130	60-130	MSD	40
Volatile Organic Compounds				
1,1-Dichloroethene	66 - 127	66 - 127	MSD	40
1,2-Dichloroethane	70 - 125	70 - 125	MSD	40
1,4-Dichlorobenzene	80 - 120	80 - 120	MSD	40
2-Butanone (Methyl Ethyl Ketone)	60 - 130	60 - 130	MSD	40
Benzene	80 - 121	80 - 121	MSD	40
Carbon Tetrachloride	78 - 129	78 - 129	MSD	40
Chlorobenzene	80 - 121	80 - 121	MSD	40
Chloroform	75 - 121	75 - 121	MSD	40
Tetrachloroethene	80 - 124	80 - 124	MSD	40
Trichloroethene	80 - 117	80 - 117	MSD	40
Vinyl Chloride	53 - 132	53 - 132	MSD	40
Herbicides				
2,4,5-TP (Silvex)	48 - 126	48 - 126	MSD	40
2,4-D	54 - 96	54 - 96	MSD	40

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Table A7-4. Laboratory Control Limits for Matrix Spike and Laboratory Control Samples in Surface Water, MET Elutriate, SBLT Leachate, and TCLP Leachate Samples.

Analysis	Accuracy		Precision	
	Matrix Spike ^a Recovery (percent)	LCS Recovery (percent)	Type of Duplicate ^b	Control Limit RPD
Vista				
Chlorinated Dioxins and Furans				
1,2,3,4,6,7,8-HpCDD	50-150	50-150	LCSD	50
1,2,3,4,6,7,8-HpCDF	50-150	50-150	LCSD	50
1,2,3,4,7,8,9-HpCDF	50-150	50-150	LCSD	50
1,2,3,4,7,8-HxCDD	50-150	50-150	LCSD	50
1,2,3,4,7,8-HxCDF	50-150	50-150	LCSD	50
1,2,3,6,7,8-HxCDD	50-150	50-150	LCSD	50
1,2,3,6,7,8-HxCDF	50-150	50-150	LCSD	50
1,2,3,7,8,9-HxCDD	50-150	50-150	LCSD	50
1,2,3,7,8,9-HxCDF	50-150	50-150	LCSD	50
1,2,3,7,8-PeCDD	50-150	50-150	LCSD	50
1,2,3,7,8-PeCDF	50-150	50-150	LCSD	50
2,3,4,6,7,8-HxCDF	50-150	50-150	LCSD	50
2,3,4,7,8-PeCDF	50-150	50-150	LCSD	50
2,3,7,8-TCDD	50-150	50-150	LCSD	50
2,3,7,8-TCDF	50-150	50-150	LCSD	50
OCDD	50-150	50-150	LCSD	50
OCDF	50-150	50-150	LCSD	50
Total heptachlorinated dioxins	--	--	LCSD	50
Total heptachlorinated furans	--	--	LCSD	50
Total hexachlorinated dioxins	--	--	LCSD	50
Total hexachlorinated furans	--	--	LCSD	50
Total pentachlorinated dioxins	--	--	LCSD	50
Total pentachlorinated furans	--	--	LCSD	50
Total tetrachlorinated dioxins	--	--	LCSD	50
Total tetrachlorinated furans	--	--	LCSD	50
PCB Congeners				
Dioxin-like PCB congeners (WHO list)	NA	50-150	LD/LCSD	50
PCB-77	NA	50-150	LD/LCSD	50
PCB-81	NA	50-150	LD/LCSD	50
PCB-105	NA	50-150	LD/LCSD	50
PCB-114	NA	50-150	LD/LCSD	50
PCB-118	NA	50-150	LD/LCSD	50
PCB-123	NA	50-150	LD/LCSD	50
PCB-126	NA	50-150	LD/LCSD	50
PCB-156	NA	50-150	LD/LCSD	50
PCB-157	NA	50-150	LD/LCSD	50
PCB-167	NA	50-150	LD/LCSD	50
PCB-169	NA	50-150	LD/LCSD	50
PCB-170	NA	50-150	LD/LCSD	50
PCB-180	NA	50-150	LD/LCSD	50
PCB-189	NA	50-150	LD/LCSD	50
187 non-planar PCB congeners	NA	50-150	LD/LCSD	50

Notes:

^aMatrix spike samples will be analyzed for surface water and for elutriates/leachates if sufficient sample volume is generated. In cases of limited elutriate/leachate volume, only laboratory control samples will be analyzed.

^bLaboratory duplicates or matrix spike duplicates will be analyzed for surface water and for elutriates/leachates if sufficient sample volume is generated. In cases of limited elutriate/leachate volume, duplicate laboratory control samples will be analyzed instead.

LCS - laboratory control sample MSD - matrix spike duplicate
LCSD - laboratory control sample duplicate NA - Not applicable
LD - laboratory duplicate RPD - relative percent difference

Control limits are updated periodically by the laboratories. Control limits that are in effect at the laboratory at the time of analysis will be used for sample analysis and data validation. These may differ slightly from the control limits shown in this table.

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Table B2-1. Sample Containers, Preservation, Holding Times, and Sample Volume Requirements.

Sediment	Containers ^a		Preservation	Holding Time	Sample Size ^b
	Type	Size			
Grain size (sediment)	G/P	16 oz	4±2°C	6 months	300 g
Specific gravity	G/P	8 oz	4±2°C	6 months	100 g
Total sulfides	WMG	2 oz	No headspace; 5mL 2N Zn Acetate 4±2°C (do not freeze)	7 days	5 g
Ammonia	WMG	4 oz	4±2°C	7 days	40 g
Total organic carbon	WMG	4 oz	4±2°C	28 days	1 g
Mercury	WMG	2 oz	4±2°C	28 days	5 g
Metals and total solids	WMG	4 oz	4±2°C	6 months ^e	10 g
TPH - diesel- and oil-range	WMG	8 oz	4±2°C	14 days/40 days ^d	20 g
SVOCs	WMG		4±2°C	14 days/40 days ^d	30 - 60 g
Pesticides	WMG	16 oz	4±2°C	14 days/40 days ^d	30 g
PCB Aroclors	WMG		4±2°C	14 days/40 days ^d	30 g
PCDD/PCDFs	WMG	8 oz	4±2°C	30 days	50 g
PCB Congeners	WMG	8 oz	4±2°C	1 year/1 year ^e	50 g
Bulk Sediment (TCLP Parameters)	WMG	16 oz	4±2°C	NA	100 g
Bulk Sediment (TCLP VOC List)	WMG	1-1/2 oz septa	4±2°C	NA	5 g
TCLP Test (SV, Pest, Herb, Met)	WMG	16 oz	4±2°C	NA	100 g
TCLP Test (VOCs)	WMG	8 oz	No headspace; 4±2°C (do not freeze)	NA	25 g
MET Test	WMG	14 x 32 oz	4±2°C	NA	8000 g
SBLT Test	WMG	15 x 32 oz	4±2°C	NA	9000 g
MET Test - archived sediment	WMG	2 x 16 oz	Deep Frozen (-20°C)	1 year	as needed

Water, Elutriate/Leachate Samples	Containers		Preservation	Holding Time	Sample Size
	Type	Size			
TSS	HDPE	250 mL	4±2°C	7 days	100 mL
TDS	HDPE	1 L	4±2°C	7 days	1 liter
Total sulfides	HDPE	250 mL	NaOH/ZnAC; 4±2°C	7 days	50 mL
Ammonia	HDPE	500 mL	H ₂ SO ₄ ; 4±2°C	28 days	50 mL
TOC	AG	250 mL	H ₂ SO ₄ ; 4±2°C	28 days	50 mL
DOC	AG	250 mL	H ₂ SO ₄ ; 4±2°C	28 days	50 mL
Metals and Mercury	HDPE	500 mL	5 ml of 1:1 & HNO ₃ & 4±2°C	6 months	100 ml
TPH - diesel and oil	AG	2 x 500 mL	HCl to pH 2; 4±2°C	14 days/40 days ^d	500 mL
PAHs	AG	2 x 500 mL	Dark; 4±2°C	7 days/40 days ^f	500 mL
Phthalates	AG	2 x 500 mL	Dark; 4±2°C	7 days/40 days ^f	500 mL
Pesticides	AG	2 x 1 L	Dark; 4±2°C	7 days/40 days ^f	1 liter
PCB Aroclors	AG	2 x 1 L	Dark; 4±2°C	7 days/40 days ^f	1 liter
PCDD/PCDFs	AG	1 L	Dark; 4±2°C	30 days/45 days ^g	1 liter
PCB Congeners	AG	2 x 1 L	Dark; 4±2°C	1 year/1 year ^e	1 liter
MET test site water	AG	26 x 1 L	Dark; 4±2°C	NA	26 liters

Notes:

^a Size and number of containers may be modified by analytical laboratory

^b All samples will need a minimum of 2.5% QA (see Table B2-2). Collection of 3x normal sample size listed will be necessary.

^c Metals (except mercury) may be held at -20°C for 2 years (PSEP 1986).

^d Holding time is 14 months to extraction and extracts must be analyzed within 40 days from extraction.

^e Holding time is 1 year to extraction, and extracts must be analyzed within 1 year from extraction.

^f Holding time is 7 days to extraction, and extracts must be analyzed within 40 days from extraction.

^g Holding time is 30 days to extraction, and extracts must be analyzed within 45 days from extraction.

WMG - Wide Mouth Glass

AG - Amber Glass

HDPE - High Density Polyethylene

G/P - Glass or Plastic

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Table B2-2. Summary of Estimated Numbers of Sediment Chemical Mobility Field QA Samples.

Sample Type	Samples	Blind Field Sample Splits ^a	Total Number of Field Samples
Surface Water			
Conventionals ^b	11	1	12
Metals	9	1	10
SVOCs	6	1	7
PCB Aroclors	9	1	10
PCB Congeners	9	1	10
Pesticides	6	1	7
Total Petroleum Hydrocarbons	7	1	8
Dioxins/Furans	6	1	7
Sediment			
Conventionals ^c	11	1	12
Metals	9	1	10
SVOCs	6	1	7
PCB Aroclors	9	1	10
PCB Congeners	9	1	10
Pesticides	6	1	7
Total Petroleum Hydrocarbons	7	1	8
Dioxins/Furans	6	1	7
TCLP Analytes ^d	11	1	12

Notes:

^a Field split sample numbers based on a minimum frequency of 2.5%.

^b All surface water samples will be analyzed for TSS, TDS, TOC, and DOC. Surface water samples will be filtered in the field for DOC.

^c All sediment samples will be analyzed for total solids, grain size, and TOC.

^d Field QC samples for volatiles will include one or more trip blanks in addition to the indicated samples.

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